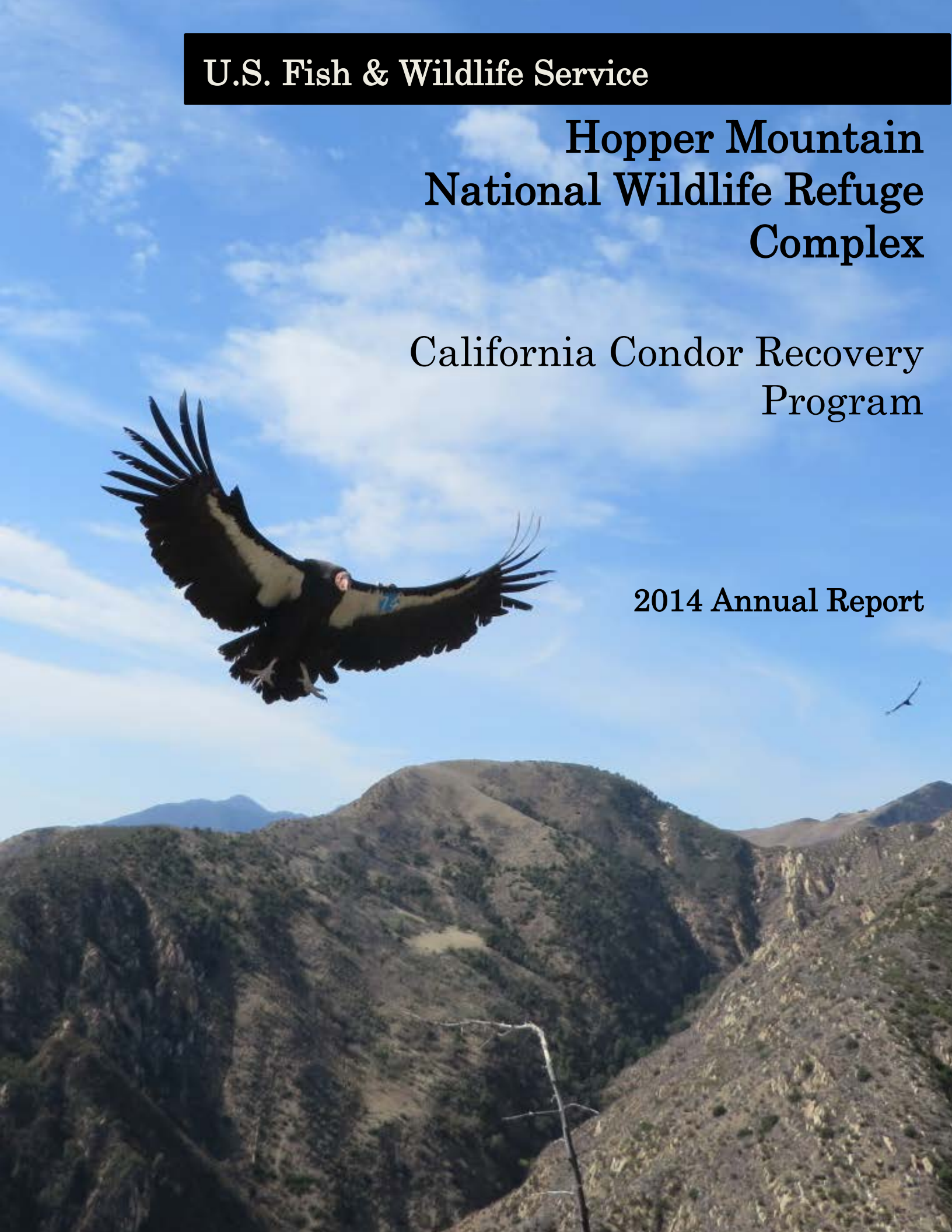
U.S. Fish & Wildlife Service

Hopper Mountain National Wildlife Refuge Complex

California Condor Recovery Program



2014 Annual Report

On the Cover: Male condor, #374, soars over the Tom's Canyon nest territory at Hopper Mountain NWR. Photo Credit: Molly Astell, Santa Barbara Zoo

Prepared By

Joseph Brandt, Supervisory Wildlife Biologist, USFWS
Josh Felch, Biological Science Technician, USFWS

U.S. Fish and Wildlife Service
2493 Portola Road, Suite A
Ventura, CA 93003
Telephone: (805) 644-5185

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We would also like to acknowledge hunters using non-lead ammunition for their help keeping condors and other wildlife safe from the perils of lead toxicosis.

List of Contributors

USFWS Condor Field Team
Joseph Brandt, Supervisory Wildlife Biologist
Laura Mendenhall, Wildlife Biologist
Geoffrey Grisdale, Wildlife Biologist
Devon Pryor, Biological Science Technician
Josh Felch, Biological Science Technician

Refuge Management Team
Michael Brady, Project Leader
Ken Convery, Deputy Project Leader
Dan Tappe, Refuge Manager
Jason Storlie, Complex Biologist
Matthew Hillman, Refuge Specialist

Santa Barbara Zoo Staff
Estelle Sandhaus, Director of Conservation and Research
Devon Pryor, Conservation and Research Associate
Molly Astell, Condor Nesting Technician

USFWS Volunteer Interns
Matt Blois
Leah Harper
Victoria Hawk
Stephanie Herrera
Amy List
Leah Medley

Great Basin Institute Research Associates
Stephanie Herrera
James Ridgely
Mary Scofield
Mandy Wegmann

Executive Summary

The Hopper Mountain National Wildlife Refuge Complex manages a reintroduced California condor population in Southern California. The Bitter Creek and Hopper Mountain National Wildlife Refuges are used as the primary management locations for the release, monitoring, and recapture of condors in this region.

As of December 31, 2014, the California condor population managed directly by the U.S. Fish and Wildlife Service (Service) consisted of 66 free-flying condors. Three wild chicks fledged from three nests in 2014 with assistance from the Service and the Santa Barbara Zoo's Nest Guarding Program. Two of these nests were monitored using the remote nest cameras. As a result of terrestrial predator activity (bobcat) near the release site, no captive reared condors were released in 2014. This year was the first time population size declined since 2001. Still, the reintroduced condor population continues to recolonize its former habitat, exemplified by increased condor activity in the Northern Tehachapi and Southern Sierra Nevada Mountains.

The field team attempted to trap the each individual in the population twice during the year to monitor for lead exposure and to maintain VHF and/or GPS transmitters. Condors are exposed to lead when they ingest carrion or gut piles that have been shot with lead ammunition. As the population's range has expanded, trapping has become more difficult with seven condors (10% of the population) evading trapping in 2014.

Lead exposures continued to occur in the population with 10 condors (15%) requiring treatment for elevated blood lead levels in 2014.

There were 11 condor deaths in 2014. Two deaths were newly fledged condors, three were recently released condors, two were 2013 releases, one was a longtime time captive that was released in 2011, one was a pre-release condor which died of a bacterial infection in the Bitter Creek NWR flight pen, and another was killed while captive when a bobcat gained access to the flight pen at Hopper Mountain NWR.

Condors continued to inhabit the northern Tehachapi Mountains and interact with humans in the residential montane communities of Bear Valley Springs, Stallion Springs and Alpine Forest Park. The field team's ability to assist with condor activity in these areas was greatly reduced due to a reduction in staff size.

The Service, with a great deal of support from the Santa Barbara Zoo, continued showcasing condor nesting behavior and management on the Facebook page, "The

Condor Cave", which had increased its following by 113% with a total of 2,149 followers as of December 31, 2014. Other outreach activities included tours of each wildlife refuge, presentations to interest groups, elementary, high school, and college students, and interviews with media outlets including a story in the Los Angeles Times.

Staffing levels were of concern in 2014 with one position being discontinued, another being vacated because it reached the end of its term, and another being vacated because the employee transferred to a higher level position within the Service. As a result, more than 18 years condor specific experience was lost.

Table of Contents

List of Figures

List of Tables

Introduction

The California condor [*Gymnogyps californianus*] is a federally listed endangered species. The current recovery priority ranking for the California condor is 4C. The "4" designation indicates that the California condor is a monotypic genus that faces a high degree of threat and has a low potential for recovery. The "C" indicates conflict with construction, development projects, or other forms of economic activity.

California condors are among the largest flying birds in the world, with a wingspan measuring up to 2.9 meters (9.5 feet; Photo 0.0.1).

Photo 0.0.1: California condor #147 flying over Bitter Creek NWR Ranch. *Photo credit: Laura Mendenhall, USFWS.*

Condors are a long-lived species with an estimated lifespan of 60 years. They are slow to mature and typically begin to reproduce at six years of age. Condors often form long-lived pairs and fledge one chick every other year. If a nestling fledges relatively early (in late summer or early fall), its parents may nest again the following year (Snyder and Hamber 1985).

California condor habitat can be categorized into nesting, foraging, and roosting components (USFWS 1975). Condors forage in the open terrain of foothill grassland, oak savanna, and woodland habitats, and on the beaches of steep mountainous coastal areas when available. Condors maintain wide-ranging foraging patterns throughout the year, which is an important adaptation for a species that may be subjected to an unpredictable food supply (Meretsky and Snyder 1992). Condors at interior locations feed on the carrion of mule deer, tule elk, pronghorn antelope, feral hogs, domestic ungulates, and smaller mammals, while the diet of condors feeding on the coast also includes the carrion of whales, sea lions, and other marine species (Koford 1953; USFWS 1984; Emslie 1987; USFWS, unpubl. data). California condors are primarily a cavity nesting species and typically choose cavities located on steep rock formations or in the burned out hollows of old-growth conifers such as coastal redwood and giant sequoia trees (Koford 1953; Snyder et al. 1986). Less typical nest sites include cliff ledges, cupped broken tops of old-growth conifers, and in several instances, nests of other species (Snyder et al. 1986; USFWS 1996). Condors repeatedly use roosting sites on ridgelines, rocky outcrops, steep canyons, and in tall trees or snags near foraging grounds or nest sites (USFWS 1984).

The U.S. Fish & Wildlife Service (Service) Hopper Mountain National Wildlife Refuge Complex (Complex) serves as the lead office for the California Condor Recovery Program (Recovery Program) and is one of many partners that support this multi-state and international recovery effort. The Complex has participated in the California condor reintroduction effort since 1992. The Service operated a number of different release sites both on refuges and on U.S. Forest Service lands and since has released condors from the captive breeding facilities annually. Over time, these releases led to the establishment of the Southern California condor population, the group of condors directly managed by the Complex's Condor Field Team (field team).

Over the last 22 years, the field team has been responsible for the continued monitoring and management of the reintroduced population, working both on and off refuge. Today, two of the wildlife refuges from the Complex, Bitter Creek National Wildlife Refuge (Bitter Creek NWR) and Hopper Mountain National Wildlife Refuge (Hopper Mountain NWR) are the primary management locations for the Southern California condor population (Photo 0.0.2), which currently inhabits portions of Santa Barbara, Ventura, Los Angles, Kern, Tulare and Inyo Counties.

Photo 0.0.2: Bitter Creek National Wildlife Refuge Entrance Gate Sign. *Photo credit: USFWS*

The California Condor Recovery Plan (Recovery Plan) provides the overarching guidance for field activities. The primary objective driving the reintroduction effort is the establishment of one of the two wild, self-sustaining populations of 150 individuals with 15 breeding pairs (USFWS 1996). The Recovery Plan consists of five key actions: 1) establish a captive breeding program, 2) reintroduce California condors into the wild, 3) minimize mortality factors, 4) maintain condor habitat, and 5) implement condor information and educational programs (USFWS 1984). In accordance with the Recovery Plan, "Released California condors should be closely monitored by visual observation and electronic telemetry" (USFWS 1984).

To support the second key action in the Recovery Plan, the field team monitors the free-flying population of condors to identify threats and reduce adverse effects to condors, including minimizing mortality factors. Each refuge provides facilities designated for trapping and holding condors, which is necessary for attaching tags and transmitters to condors and performing routine health

checks. Another key action in the Recovery Plan is to minimize mortality factors in the natural environment. In accordance with the Recovery Plan, "Condor blood, feathers, eggshells, and other tissues will be collected opportunistically and analyzed for heavy metals, pesticides, and other potential contaminants" (USFWS 1984).

The field team is comprised of a number of different positions including Service employees, partner employees, and volunteers. In 2014, the Service employed one full-time permanent supervisory wildlife biologist, two full-time term wildlife biologists, and two full-time term biological science technicians.

There were a number of changes in Service field team staffing levels in 2014. One of the full--time biological science technician positions was discontinued in February 2014, this position was not re-filled. The two wildlife biologist positions were also vacated in September (due to end of term) and November (due to transfer) of 2014. These positions remained vacant until the following year. The Santa Barbara Zoo employed one full-time nesting technician and a research coordinator who spent about a third of her time assisting the condor field team.

In addition to the various staff positions, the Complex has four intern positions that are filled throughout the year. Individuals who volunteered for these positions committed to working 40 hours a week over six months for a stipend. These positions transitioned from being Service volunteers to positions provided via a Cooperative agreement with the Great Basin Institute. This transition was due to a change in Service policy which prohibited the Service from directly providing interns a living stipend.

Some field activities are also supported by unpaid volunteers or other program partners. Unpaid volunteers primarily assisted with monitoring nests during the eight month nesting season but also assisted with tracking via radio telemetry on a more limited basis. A variety of support also came from other program partners. The Los Angeles Zoo provided assistance in caring for sick and injured condors and helped during handling events and nest entries. The Friends of the California Condor Wild and Free helped with outreach events and project work such as building blinds or flight pen maintenance.

This annual report describes the activities conducted by the field team. Primary management operations undertaken by the field team are described in detail. The field team resources attributed to each operation are reported for the year. The outcomes of these activities are described and discussed.

1.0 Funding

In 2014, the Hopper Mountain National Wildlife Refuge Complex Office received $691,047 in U.S. Fish and Wildlife Service Recovery funds (1113). The Complex used these resources to fund the field team and their activities as well as a programmatic condor coordinator position. Refuge management funds (126x) also contributed significantly to condor related activities.

2.0 Actions

The condor field team at the Hopper Mountain National Wildlife Refuge Complex performs seven primary actions with the goal of achieving a self-sustaining population of condors in California (Figure 2.0.1). The actions performed are: Monitoring Resource Use, Lead Monitoring and Mitigation, Detecting Mortalities, Nest Management, Captive Releases & Transfers, Behavioral Modification, and Outreach. These actions are meant to address the major threats condors face in the wild (Figure 2.0.1).

2.1 Monitoring Resource Use

The loss and modification of California condor foraging, roosting, and nesting habitat is recognized as a historic threat to the recovery of the species. As noted in the 1979 Recovery Plan (USFWS 1979), adequate nest sites, roost sites, and foraging habitat with adequate food are the basic habitat needs of the condor. The 1996 Recovery Plan acknowledges the presence of sufficient remaining condor habitat in the Southwestern United States but notes that maintaining this habitat is a key recovery action (USFWS 1996). The field team monitors nesting, roosting, and foraging habitat use across Southern California using data from global positioning system (GPS) transmitters attached to condors. Transmitters are assigned to individuals of different sexes and age classes while also considering breeding status or captive release circumstances. GPS transmitter locations are used to understand condor resource use over a large geographic and temporal scale.

The field team's goal is to equip all California condors in the Southern California population with either two very high frequency (VHF) transmitters attached to retrices (Kenward 1978) or a combination of one VHF transmitter or one patagial-mounted (Wallace 1994) GPS transmitter. Some condors in the population do not have transmitters because transmitters are dropped or malfunction in between trapping seasons.

In 2014, GPS transmitter locations were produced by three types of solar-powered GPS transmitters that are patagial-mounted to a subset of individual condors during routine handling. The Microwave Telemetry Inc. (MTI) patagial Argos/GPS PTT were used from January 1, 2014 through August 1, 2014. Starting in November of 2013, the field team deployed GSM (Global System for Mobile Communications) transmitters (GSM; Microwave Telemetry, Inc. ©, Columbia, Maryland; GSM; Cellular Tracking Technologies, LLC, Somerset, Pennsylvania) (Photo 2.1.1 and Photo 2.1.2). GSM transmitters use cellular towers to transmit GPS data and are capable of collecting location data at 30 second intervals compared to the one hour intervals generated by the Argos/GPS PTTs. (continued on page7)…

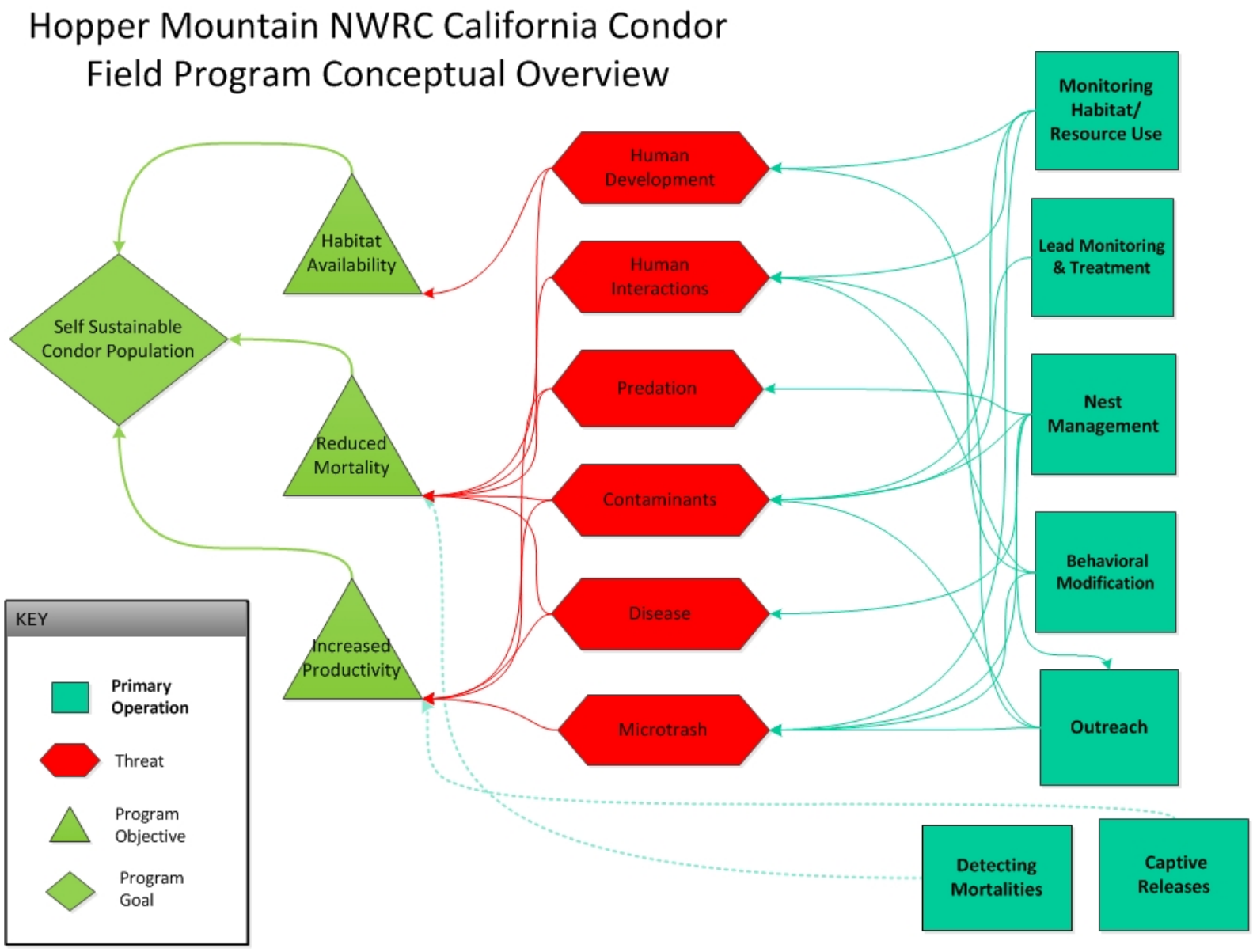


Figure 2.0.1: A conceptual model for the Hopper Mountain NWRC California Condor Field Program. The program's goal is to establish a wild self-sustaining population of condors. The three program objectives are limited by one or more of the six identified threats, which are in turn addressed by the seven primary operations.

Photo 2.1.1: Condor #625 wearing a MTI GPS/GSM transmitter. Photo Credit: *Stephanie Herrera, Great Basin Institute.*

Photo 2.1.2: Condor #518 wearing a prototype CTT GPS/GSM transmitter. *Photo credit: Joseph Brandt, USFWS.*

The MTI GSM transmitters are very similar in design to the ARGOS/GPS transmitters. The Cellular Tracking Technologies (CTT) Transmitters were developed in collaboration with the Service. Prototypes were tested on condors being held in the flight pen located at Bitter Creek NWR.

The field team monitors GPS transmitter locations daily to target locations of interest for on-the-ground investigation, an action referred to as ground-truthing. Non-proffered feeding events and potential threats are prioritized for ground-truthing. A non-proffered feeding event occurs when condors feed on carrion or other food items that are not provided by the condor field team.

GPS transmitter locations also inform program-wide objectives via long-term research projects including efforts to map condor habitat (Cogan et al. 2012), assess the impact and distribution of lead on the landscape (Kelly et al. in press), and monitor the impacts of the Ridley-Tree Condor Preservation Act. Findings from these studies may influence management strategies and policy aimed at addressing lead-based ammunition and other threats to condor survival.

2.2 Lead Monitoring and Mitigation

Lead poisoning is a major ongoing concern for all California condors, including those in the Southern California population. The Ridley-Tree Condor Preservation Act (2008) regulates the use of lead ammunition in California and may reduce the amount of lead-contaminated carrion available to scavengers throughout condor range. However, despite this regulation, there is still potential for condors to encounter lead fragments from animals shot with lead ammunition (Finkelstein et al. 2012). The purpose of monitoring and mitigating lead exposure in California condors is to inform management and policymaking decisions and to prevent lead related mortalities.

Twice each year, the field team attempts to trap and handle the entire Southern California condor population to monitor blood lead levels and, if necessary, treat condors for lead exposure. Handling

occurs once in early summer (starting in June) and again in late fall (starting in November). Some condors are tested opportunistically at additional times throughout the year when a lead exposure is suspected or when they are handled for other purposes. The field team also samples the blood lead levels of wild condor chicks during routine nest entries (see: Nest Management section). While handling each condor, the field team collects three blood samples from the medial metatarsal vein using blood vials containing Edetate (EDTA). One sample is used immediately for field blood lead testing using a portable lead analyzer. Condors with a field blood lead value below 35 µg/dL are released into the wild while condors with a field blood lead value greater than or equal to 35 µg/dL are transported to the Los Angeles Zoo for treatment.

Treatment at the Los Angeles Zoo involves radiographing the condor to identify possible metallic objects in the digestive system and administering chelation treatment to remove lead from the bloodstream (Photo 2.2.1).

Chelation treatment consists of daily intramuscular injections of Calcium EDTA given in conjunction with subcutaneous fluids. Lead toxicosis can result in crop-stasis, or the inability to transfer food past the crop, which can result in severe weight loss and starvation. Treatment time varies between weeks to months depending on the level of lead exposure. Zoo technicians are able to identify metallic objects in radiographic images but are not able to determine the type or composition of these objects unless recovered. Los Angeles Zoo staff closely monitors condors with metallic-positive radiographs. When possible, they recover castings and fecal material and remove metallic objects for analysis. A condor's treatment ends when its lab blood lead level is less than35 µg/dL and it is no longer showing clinical signs of lead toxicosis.

Photo 2.1.1: Los Angeles Zoo Condor Keepers prepare a condor with lead toxicosis for radiographing. *Photo credit: Jon Myatt, USFWS.*

Additional blood samples collected from condors are refrigerated and sent to the California Animal Health and Food Safety Laboratory System at UC Davis for lab analysis of lead concentrations and the Microbiology and Environmental Toxicology Department at the University of California Santa Cruz for lead isotope analysis. In addition, feather samples collected from trapped condors are used to monitor lead exposure over long periods.

2.3 Detecting Mortalities

Identifying the causes of California condor mortalities is an important aspect of California condor recovery. Despite decades of research, the reasons for the species' decline in historic populations are poorly documented. Understanding the factors contributing to mortalities in

the reintroduced wild populations is essential to the conservation of the species (Rideout et al. 2012). It is important to quickly identify and locate dead condors in order to determine the cause of death and detect any immediate threats that may affect other condors. Detection of mortalities by radio telemetry and GPS monitoring is one of the highest priority operations conducted by the field team.

The field team usually detects condor mortalities using VHF transmitters attached to each condor. All deployed VHF transmitters have an automatic mortality signal function. After a 12-hour period of inactivity, the VHF transmitter will emit a beep with a frequency about twice as fast as the normal rate, also called a mortality signal. When a mortality signal is detected, it can indicate the VHF transmitter has fallen off the condor via a molted feather, the condor has not moved for some time (mortality signals can occur in the morning before the condor has moved from its roost), or the condor is dead.

GPS transmitters can also alert the field team to potential condor mortalities. When reviewing condor GPS transmitter locations, stationary GPS transmitter locations for a single condor over an unusually long period may indicate mortalities. The newly deployed GSM transmitters are not as effective in indication condor mortalities (See Discussion).

Condors are monitored throughout the day using radio telemetry at both Hopper Mountain NWR and Bitter Creek NWR. If a condor goes undetected for more than one week, the field team will expand their search for the missing condor by mobile tracking. Mobile tracking involves driving to various off-refuge locations throughout Southern California condor range to search for the signal of the missing condor (Photo 2.3.1).

Condor chick mortalities are detected during routine nest monitoring (see: Nest Management section). Monitoring nests regularly allows the field team to identify chick mortalities immediately or shortly after they occur.

All condor carcasses recovered from the wild population were transferred to the National Fish and Wildlife Forensics Laboratory in Ashland, Oregon for postmortem examination in order to determine cause of death.

Photo 2.3.1: Mobile tracking at Wind Wolves Preserve. *Photo Credit: USFWS*.

2.4 Nest Management

Nesting in the Southern California condor population began in 2001. Between 2001 and 2006, only two condor chicks fledged from 16 nests. The field team identified the leading cause of nest failure as the consumption of small,

human-made materials, also called microtrash, brought to nests by parent condors. Documented microtrash items include nuts, bolts, washers, copper wire, plastic, bottle caps, glass, and spent ammunition cartridges (Mee et al. 2007) (Photo 2.4.1).

Photo 2.4.1: Microtrash removed from a wild chick in 2008. *Photo Credit: USFWS*.

When chicks ingest large quantities of these items it can result in digestive tract impaction, evisceration, internal lesions, and death (Grantham 2007; Snyder 2007; Rideout et al. 2012). In 2007, the Service partnered with the Santa Barbara Zoo to create an intensive nest management strategy, the California Condor Nest Guarding Program. The program is modeled after a nest guarding program for the endangered Puerto Rican Parrot (Lindsey 1992) and combines monitoring nests with direct intervention to detect threats to thwart nest failure. The goals of the California Condor Nest Guarding Program are to identify the leading causes of nest failure and to increase the number of wild fledged condor chicks in Southern California.

The field team locates nests using visual observations, radio telemetry, and ground-truthing GPS transmitter locations of breeding age condors early in the nesting season (Mee et al. 2007; Snyder et al. 1986). The field team first identifies pairs by tracking courtship behaviors. Existing pairs will often re-nest in previously used cavities or in cavities located nearby. A nest is identified following visual confirmation of an egg. In the case of difficult-to-view cavities, nests are not confirmed until the field team enters the cavity to check the fertility of the egg.

Nests are observed at frequencies based on their accessibility and visibility. Observers will travel to a designated nest observation point and watch for activity from that location. Typically, each nest is observed for two hours, three to four times per week from the nest observation point. More remote nests are observed less frequently or not at all. Nest cavities that are not fully visible are monitored for attendance using radio telemetry or GPS transmitter locations.

The field team also uses footage from nest cameras to assist with nest observation. Nests with cameras are not watched from a nest observation point but instead all nest camera footage is reviewed every three to four days.

Each condor nest is routinely entered by specially trained field team members to monitor the status of the egg or chick, and to sift for and remove microtrash. The field team enters nests once during the egg stage to check the egg's fertility. During the chick stage, field team typically enters the nests when the chick

is 30, 60, 90, and 120-days old although this varies depending on nest location and available resources (Photo 2.4.2).

Photo 2.4.2: Wildlife Biologist Laura Mendenhall begins her decent to condor nest, SP14. *Credit: Mathew Hillman, USFWS.*

During each nest entry, the field team gives the chick a health exam, which includes palpating the chick's stomach and crop for foreign bodies or blockages and taking a blood sample, weight, and tail feather length measurement to assess the chick's development and overall health. In addition to the health exam, the nest is sifted for any foreign material. At 30, 60, and 120-days of age, the chick is vaccinated for West Nile virus. The 120-day nest entry is normally the last nest entry so as to discourage possible premature-fledging. During this entry, the chick is fitted with a patagial tag and VHF transmitter (Photo 2.4.3).

Photo 2.4.3: Santa Barbara Zoo Conservation and Research Associate, Devon Pryor, handles condor #733 for an exam and tagging at nest TC14 Credit: Geoff Grisdale, USFWS.

Nest interventions transpire when problems arise or when pair history dictates preventative measures should be taken to ensure success of the nest. During the egg stage, nonviable eggs are removed and replaced with dummy eggs, which are later switched with viable captive-laid eggs. Additional interventions occur as needed to mitigate threats detected through observations such as chick injuries or microtrash impactions.

Nest cameras are advantageous for interventions as they allow close monitoring of an egg or chick following an intervention that otherwise might not have been attempted because of the inability to conduct such monitoring via traditional direct observations. Program veterinarians are able to remotely assess a chick's status and recovery via recorded video clips of the chick and its

behavior that would not be possible without nest cameras.

When chicks fledge, they are monitored closely much like newly released captive-bred condors (see: Captive Releases and Transfers section), to ensure they are integrating into the population and displaying normal behavior.

In the event of a nest failure, the field team enters the nest to recover the remains of the egg or chick. Recovered eggs are collected and frozen in a conventional freezer for use in contaminants research. Chick carcasses are submitted to the U.S. Fish and Wildlife Service Wildlife Forensics Laboratory in Ashland, Oregon for necropsy.

2.5 Captive Releases and Transfers

During the fall of each year, the field team releases captive-bred juvenile California condors into the wild at Bitter Creek NWR. The purpose of releasing captive-bred condors is to augment the wild population, offset mortalities that occur in the wild, and ensure genetic diversity in the Southern California population of condors.

The California condor is one of many endangered species managed to maximize the genetic diversity present in the original population, minimize genetic loss, and emphasize optimal productivity (Ralls and Ballou 2004; USFWS 1996). As outlined in the 1996 Condor Recovery Plan, it is necessary to increase productivity beyond the California condor intrinsic rate of reproduction through a captive breeding program (USFWS 1996). Captive-bred California condors selected for release in the wild must be physically and behaviorally healthy, have been successfully socialized with other release candidates, have been kept in isolation from humans to prevent taming, and have undergone aversion training to condition avoidance of humans and human-made structures (Bukowinski et al. 2007, Clark et al. 2007, USFWS 1996).

Prior to release, condors spend time in a flight pen (or captive enclosure) at Bitter Creek NWR to allow time to transition from the breeding facility into the wild (Photo 2.5.1). These pre-release condors will spend at least six weeks in the flight pen to allow familiarization with the new surroundings and interactions with wild condors perching or feeding nearby. During this time, the field team monitors pre-release condors two to four days per week during four-hour observations to examine and record social behavior and physical health. On the day prior to release, the field team places identification tags and VHF transmitters on each condor and move condors into a secondary enclosure within the flight pen.

Photo 2.5.1: Captive-bred California condors await release in a flight pen. *Photo Credit: Angela Woodside, USFWS.*

The field team typically releases California condors during the fall months (September-November) because the weather is cooler and there are fewer thermal updrafts. These weather conditions are conducive to keeping newly released condors close to the release site and to supplemental food and water sources while they are learning to fly.

Condors are usually released in trios or pairs to encourage socialization. Supplemental carrion is provided near the release pen in order to lure other free-flying condors in to feed and interact with the newly released condors. The field team monitors the newly released condors for a minimum of 30 days paying careful attention to social interactions, feeding, and roost selection. Additional releases take place only after the previously introduced condors roost appropriately off the ground and become familiar with the location of water and supplemental feeding sites. Supplemental feeding is an integral component of the condor release program (USFWS 1996). Supplemental food and water act as a substitute for the parental care that the released condors would have otherwise received had they fledged from a wild nest.

The field team will trap a newly released condor and return it to captivity (temporarily or permanently) if it exhibits undesirable behavior in the wild. This behavior includes approaching humans, not socializing with other condors, poor roost selection and/or the inability to locate supplemental carrion.

2.6 Behavioral Modification

The California condor is an inquisitive species whose habitat overlaps with human development. The frequency with which the condor encounters human activity and development has led to isolated incidences of habituation. Condors that have become overly habituated to human activity and structures are at greater risk to behavioral conditioning, which ultimately affects their ability to survive in the wild. A habituated condor may also cause other condors to become habituated given the social nature of the species. In some cases, condors have caused property damage at habituation sites. Condors can also jeopardize human safety in the event a habituated condor approaches people.

Cade et al. (2004) grouped undesirable behavior into three categories. Type I behavior is considered normal and is categorized by condors remaining at least 15 meters from people, exploring anthropogenic objects infrequently, landing on human-made structures limited to those that resemble natural perches or offer adequate protection from predators, and abandoning the undesirable behavior after one to two deterrence activities, i.e., "hazing" or "aversion training" (Cade et al. 2004). Hazing is defined as "an activity directed at a condor by humans in attempt to discourage a behavior" while aversion training is defined as "making an undesirable activity or behavior unpleasant without direct human interaction" (Grantham 2007).

Type II behavior is an "intermediate category", and is exemplified by condors

"landing or flying closer than 15 meters to humans, but maintaining an 'individual distance' when approaching or being approached by humans" and "circumventing humans when investigating their belongings, allowing close human approach only when a clear escape route is present" and "fleeing when hazed" (Cade et al. 2004).

Type III behavior is of utmost concern, and "consists of condors allowing close human approach when no escape route is present (no fear of being boxed in), seeking out and initiating contact with humans, allowing touching and handling (including capture)" and "not responding to hazing, and showing no fear of humans" (Cade et al. 2004). Some of these types of behaviors have been observed in similar vulture species in the United States including the black vulture [*Coragyps atratus*] (Lowney 1999).

While Type I and Type II behavior are considered normal exploratory and play activities that may be adaptations related to foraging and the social nature of the species, these behaviors might lead to the development of Type III behaviors. In turn, case studies have shown that Type III behavior can be changed to Type I or Type II behavior by hazing the individual or temporarily removing the offending individual from the population, though this is not effective in every situation (Cade et al. 2004).

Although lowest on the undesirable behavior spectrum, even Type I behaviors can cause risks to condors. While this category is not associated with approaching humans, it does result in condors approaching or landing on human structures. In many cases, these structures are hazardous because condors can become entangled or entrapped on or in structures or ingest poisonous household or industrial items, leading to injury or death (Photos 2.6.1 and 2.6.2).

The field team employs aversion training, hazing, and trapping of habituated condors as means to manage Type I and II behaviors and prevent Type III behaviors and subsequent injury to condors. In the early stages of reintroducing condors into the wild, a number of mortalities were attributed to power line collisions and electrocution. As a result, pre-release flight pens feature mock power poles that deliver nonfatal electric shocks to any condor landing on the structure. This aversion training has proven very effective in conditioning pre-release condors to avoid these structures once they join the free-flying population.

Photo 2.6.1: Condor #412 entangled and hanging from a communications tower in May 2011. The injuries from this incident were so severe the condor was euthanized. *Photo credit: USFWS*

Photo 2.6.2: Condor #63 covered in motor oil at Rancho la Cruz. *Photo credit: USFWS*

The field team identifies habituation sites and habituated condors using radio telemetry, GPS transmitter data, visual monitoring, and responding to reports of condors engaged in undesirable behavior. Hazing, in combination with removing any potential attractants, has been effective at discouraging condor activity at many locations.

Hazing techniques include making loud noises, clapping and waving hands, using slingshots with non-injurious food items (e.g. grapes and gumdrop candies), spraying streams of water from hoses and water guns, setting up motion-activated sprinklers, and using restrained dogs. Hazing is an effective deterrent only when done quickly and consistently. Inconsistent hazing can allow condors to develop a tolerance of the hazing techniques thereby lessening their effect.

Anti-perch deterrents are also helpful deterring condors from landing on human structures and are recommended to residents where condors. Examples of anti-perch deterrents include bird spikes, shock strips, spring wire, or bird spiders.

The capture of condors due to habituation issues is considered a last resort, but on rare occasions is necessary for the safety of the individual condor or the benefit of the population. The capture of an individual is necessary if the condor exhibits Type III behavior, exhibits Type II behavior and no longer responds to deterrence activities, or exhibits Type II behavior and the recurring stimulus presents an immediate risk of physical harm or death.

Access to the location where the undesired behavior is occurring is also an important factor. Without access to the affected individual, the only course of action to correct persistent or harmful undesirable behavior is to capture and remove that individual from the wild in attempt to break the pattern of behavior. Often times, the captive condor is given a "time out" period, usually lasting a few months or longer, and then released back into the wild. In some circumstances, however, the habituated condor's behavior warrants a permanent return to captivity.

2.7 Outreach

The field team performs outreach to create awareness and educate the public about issues pertaining to California condor conservation in Southern California. Performing outreach for condors also helps further the Service's national goals of connecting people with nature and broadening awareness of endangered species conservation and the

National Wildlife Refuge System (Photo 2.7.1).

Outreach is often targeted to help resolve immediate management issues. A common example of this is providing information to communities and local residents within condor range where the potential for condor habituation with humans and human structures is likely. In these cases, the field team communicates need to the community, coordinates with residents to prevent habituation, organizes and prepares presentations, and travels to the community to present and discuss issues with residents.

The preservation of condor foraging habitat is a priority for condor conservation according to the Recovery Plan (USFWS 1996) and the Complex's Comprehensive Conservation Plan (USFWS 2012). When possible, land managers within the species' range are encouraged to use lead-free ammunition when dispatching animals and allow dead livestock to remain on their properties. The field team also continues to provide outreach and information to government agencies to ensure they integrate information on condor biology and habitat use into land planning documents.

Photo 2.7.1: Supervisory Wildlife Biologist, Joseph Brandt, educates local Boy Scout group on condor conservation at Bitter Creek NWR. *Photo Credit: USFWS*

The field team performs a number of additional types of outreach activities with the intention of creating awareness and educating the public about condor conservation issues. The Service authorizes refuge tours, co-hosts events with program partners such as the Friends Group, and presents to local schools. When possible, the Service accommodates media requests and contributes to several social media outlets and scientific publications.

3.0 Outcomes

3.1 Monitoring Resource Use

In 2014, just over one half (34 of 66) of the Southern California condor population wore GPS transmitters for at least part of the year. GPS transmitter data included over 1,076,000 locations. GSM transmitters produced the vast majority of these locations (1,042,904 locations) compared to the Argos transmitters (33,851 locations).

Condor activity across the landscape based on this subset of California condors spanned approximately 11,800 square miles (Figure 3.1.1). Condors ranged from the San Gabriel Mountains in the south to the lower Sierra Nevada Range in the north. They ranged east into the Sierra Madre Mountains of Santa Barbara County and the westernmost flights were in the Eastern Sierras along the Tulare/Inyo County line. The areas of activity with the highest concentration were similar to previous years around Hopper Mountain NWR, Bitter Creek NWR, Bear Valley Springs, and Tejon Ranch (Figure 3.1.2).

Condor activity measured by GPS locations across the landscape was slightly less than the previous year. There were similar and more frequent exploratory flights in summer months of 2014, but not quite as expansive as similar flights from the previous year. Three particular flights are worthy of note. On June 2, 2014, GPS data for a two condors (#625 and #560) indicated that they were located at Buck Rock Fire Lookout located in Hume Lake Ranger District of Sequoia National Forest in Northern Tulare County. Corresponding to this GPS activity, the field team received reports and photos from hikers visiting the lookout of a total of nine condors were present at Buck Rock. The seven other condors (#487, #509, #563, #568, #576, #590, and #643) were not wearing GPS units but were all observed in the area by hikers over a three day period (Figure 3.1.2). On September 3, 2014, condor #326 flew into the eastern slopes of the Tehachapi Mountains traveling through an active wind farm (Figure 3.1.3). On September 16, 2014, two condors flew into Inyo county and traveled north along the eastern side of the Southern Sierras until turning west about 17 miles south of Mount Whitney to crossing the Pacific Crest and traveling back south (Figure 3.1.4). On September 18, 2014, condor # 370 roosted in the Antelope Valley for a night (Figure 3.1.5).

Nesting activity in 2013 occurred on public and private land. One nest was located in the Sespe Condor Sanctuary on the Los Padres National Forest. One nest was located on the Hopper Mountain NWR. A third nest was located on Private land east of Hopper Mountain NWR and south of the National Forest (Figure 3.1.6).

The field team confirmed nine non-proffered feeding events in 2014. The most common types of carrion observed at non-proffered feedings were pig, cow, and deer. This is similar to carrion types

from years prior (2008-2012) where cow, pig, and deer were also the most common types of carrion found at non-proffered feedings (Table 3.1.1). The field team confirmed less than half the number of non-proffered feeding events than the previous year. Fewer locations were investigated by the field team due to a decrease in staff in 2014. In spite of confirming fewer events, non-proffered feeding likely increased based on the amount of time much of the population spent away from proffered feeding sites.

Table 3.1.1: Non-proffered feeding events in 2014, 2008-2014, and in total by type of carrion. Non-proffered carrion is any food item that is not provided for condors by the condor field team.

Carrion Type	Current 2014		Years Prior 2008-2013		All Years 2008-2014	
cow	1	11%	54	37%	55	35%
pig	4	44%	53	36%	57	37%
deer	1	0%	19	13%	20	13%
horse	0	0%	8	5%	8	5%
sheep	0	0%	3	2%	3	2%
unknown	3	33%	3	2%	6	4%
coyote	0	0%	2	1%	2	1%
bison	0	0%	2	1%	2	1%
goat	0	0%	1	1%	1	1%
donkey	0	0%	1	1%	1	1%
elk	0	0%	1	1%	1	1%
Total	9		147		156	

Figure 3.1.1: 2014 estimated area of condor activity. To estimate the area of condor activity a polygon was drawn to encompass all 2014 GPS locations and smoothed with the Bezier Interpolation method.

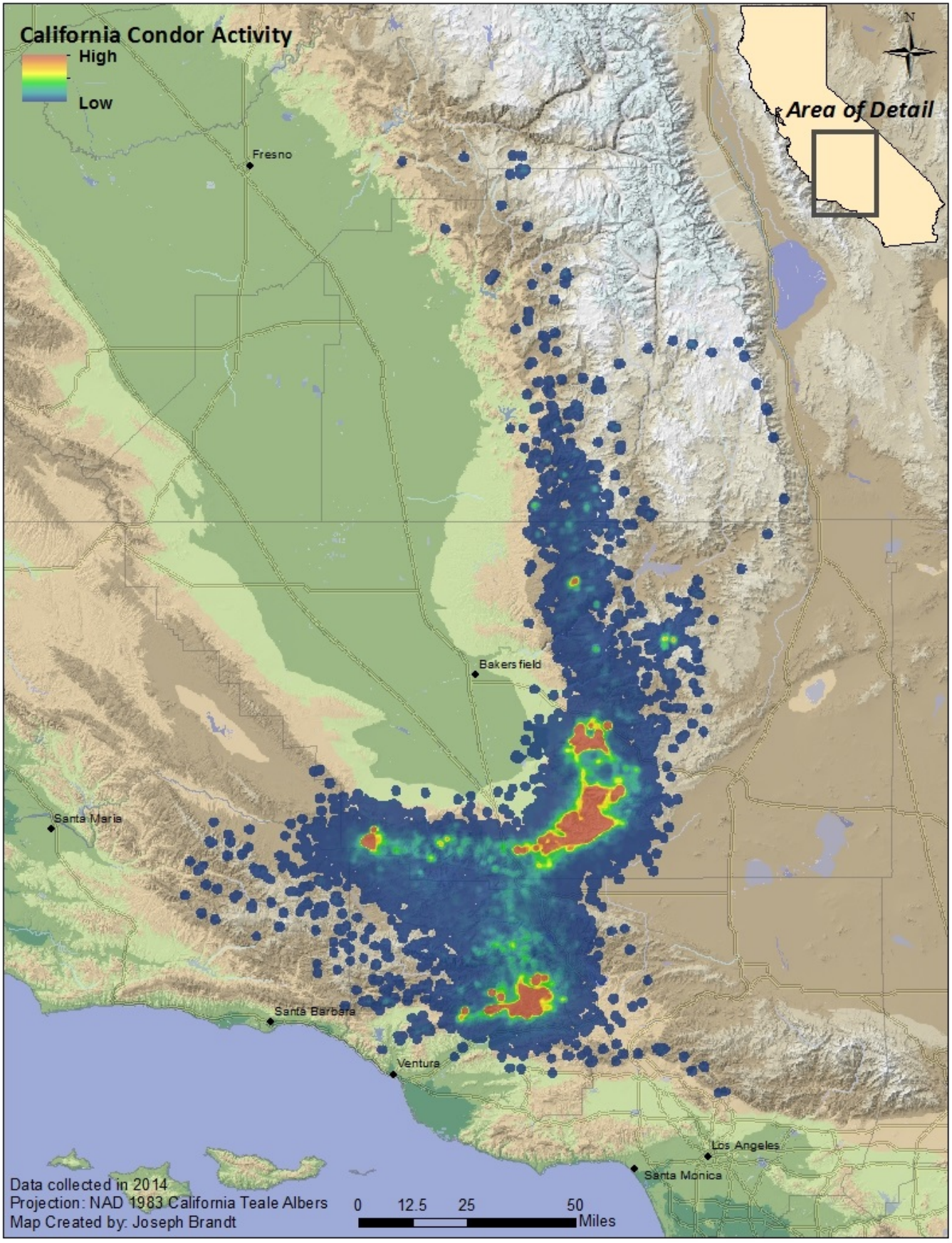


Figure 3.1.2: Condor activity in 2014 estimated using a fixed kernel density estimate (KDE) for all California condors wearing GPS transmitters. KDE averaged across individuals (n=34) using a neighborhood of one kilometer (cell size = 100 meters) and stretched using two and a half standard deviations. KDE provided by Melissa Braham, Survey Technician (Division of Forestry and Natural Resources, West Virginia University).

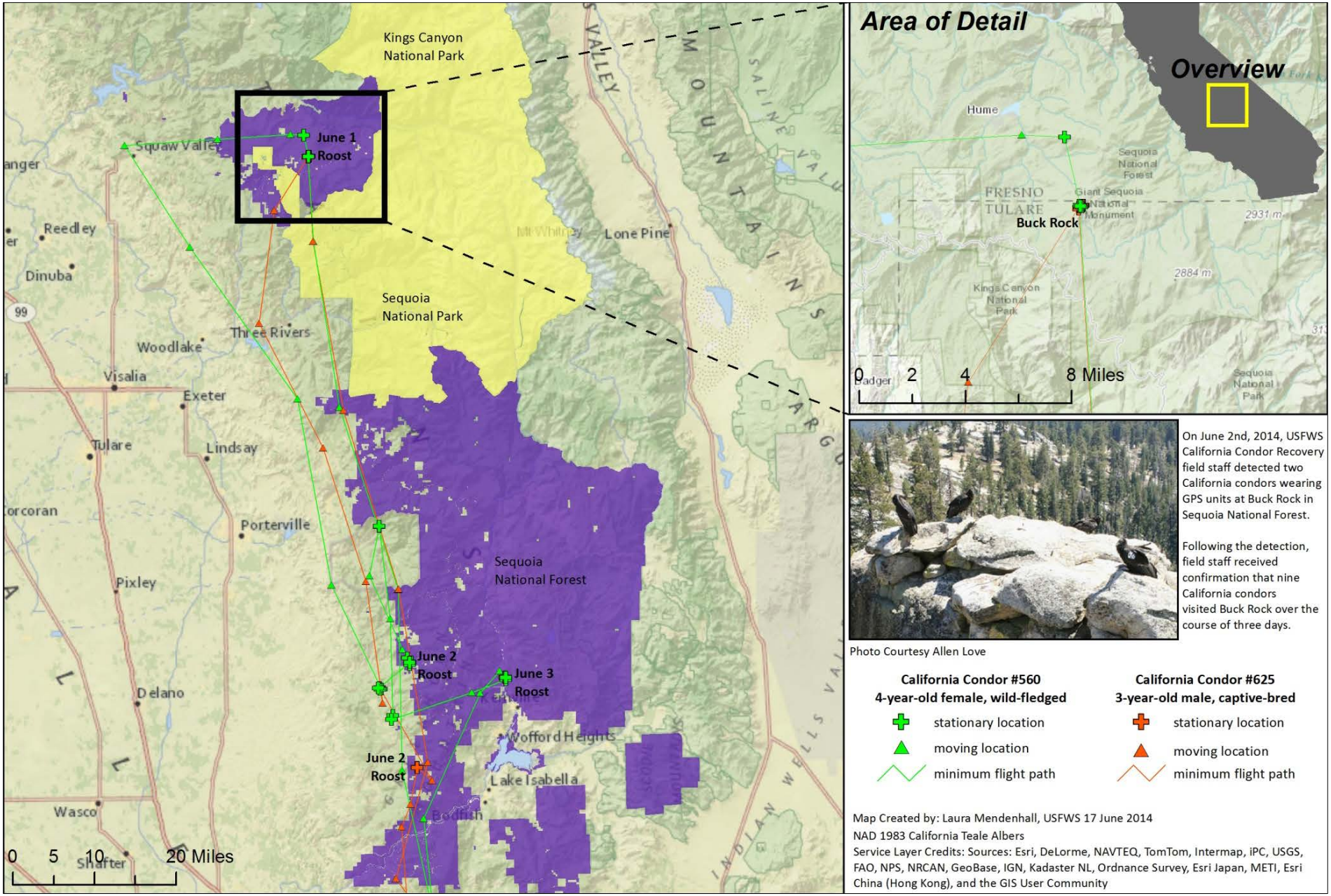
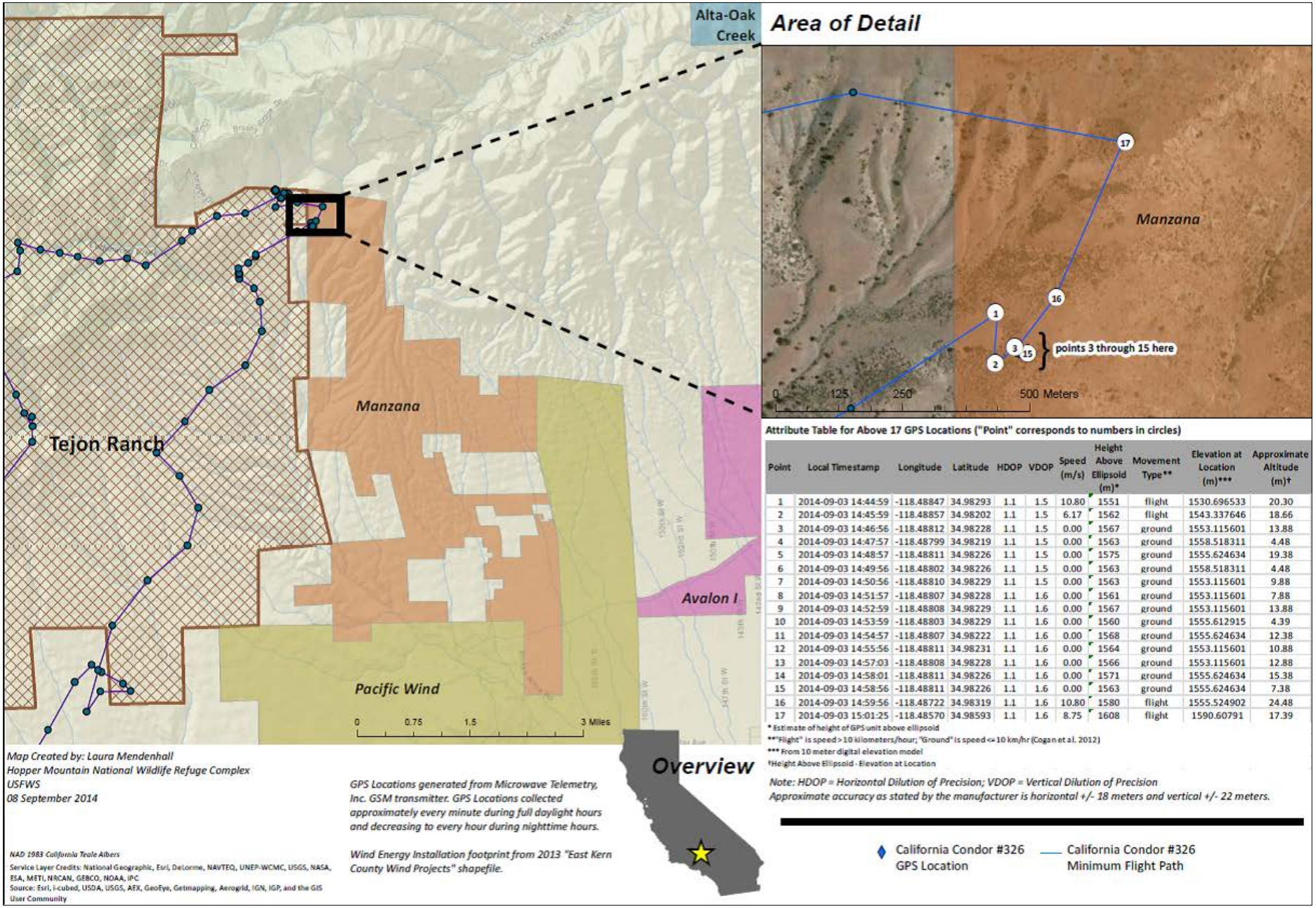


Figure 3.1.3: Exceptional flight by condors #560 and #625**.** These condors were two of nine condors observed by hikers visiting Buck Rock Fire Lookout in Sequia National Forest in Northern Tulare County.



Attribute Table for Above 17 GPS Locations ("Point" corresponds to numbers in circles)

Point	Local Timestamp	Longitude	Latitude	HDOP	VDOP	Speed (m/s)	Height Above Ellipsoid (m)*	Movement Type**	Elevation at Location (m)***	Approximate Altitude (m)†
1	2014-09-03 14:44:59	-118.48847	34.98293	1.1	1.5	10.80	1551	flight	1530.696533	20.30
2	2014-09-03 14:45:59	-118.48857	34.98202	1.1	1.5	6.17	1562	flight	1543.337646	18.66
3	2014-09-03 14:46:56	-118.48812	34.98228	1.1	1.5	0.00	1567	ground	1553.115601	13.88
4	2014-09-03 14:47:57	-118.48799	34.98219	1.1	1.5	0.00	1563	ground	1558.518311	4.48
5	2014-09-03 14:48:57	-118.48811	34.98226	1.1	1.5	0.00	1575	ground	1555.624634	19.38
6	2014-09-03 14:49:56	-118.48802	34.98226	1.1	1.5	0.00	1563	ground	1558.518311	4.48
7	2014-09-03 14:50:56	-118.48810	34.98229	1.1	1.5	0.00	1563	ground	1553.115601	9.88
8	2014-09-03 14:51:57	-118.48807	34.98228	1.1	1.6	0.00	1561	ground	1553.115601	7.88
9	2014-09-03 14:52:59	-118.48808	34.98229	1.1	1.6	0.00	1567	ground	1553.115601	13.88
10	2014-09-03 14:53:59	-118.48803	34.98229	1.1	1.6	0.00	1560	ground	1555.612915	4.39
11	2014-09-03 14:54:57	-118.48807	34.98222	1.1	1.6	0.00	1568	ground	1555.624634	12.38
12	2014-09-03 14:55:56	-118.48811	34.98231	1.1	1.6	0.00	1564	ground	1553.115601	10.88
13	2014-09-03 14:57:03	-118.48808	34.98228	1.1	1.6	0.00	1566	ground	1553.115601	12.88
14	2014-09-03 14:58:01	-118.48811	34.98226	1.1	1.6	0.00	1571	ground	1555.624634	15.38
15	2014-09-03 14:58:56	-118.48811	34.98226	1.1	1.6	0.00	1563	ground	1555.624634	7.38
16	2014-09-03 14:59:56	-118.48722	34.98319	1.1	1.6	10.80	1580	flight	1555.524902	24.48
17	2014-09-03 15:01:25	-118.48570	34.98593	1.1	1.6	8.75	1608	flight	1590.60791	17.39

* Estimate of height of GPS unit above ellipsoid
** "Flight" is speed > 10 kilometers/hour; "Ground" is speed <= 10 km/hr (Cogan et al. 2012)
*** From 10 meter digital elevation model
† Height Above Ellipsoid - Elevation at Location

Note: HDOP = Horizontal Dilution of Precision; VDOP = Vertical Dilution of Precision
Approximate accuracy as stated by the manufacturer is horizontal +/- 18 meters and vertical +/- 22 meters.

Figure 3.1.4: Exceptional flight by condor #326. In September of 2014 **c**ondor #326 flew to and landed within the foot print of the Manzana Wind facility in the eastern foothills of the Tehachapi Mountains.

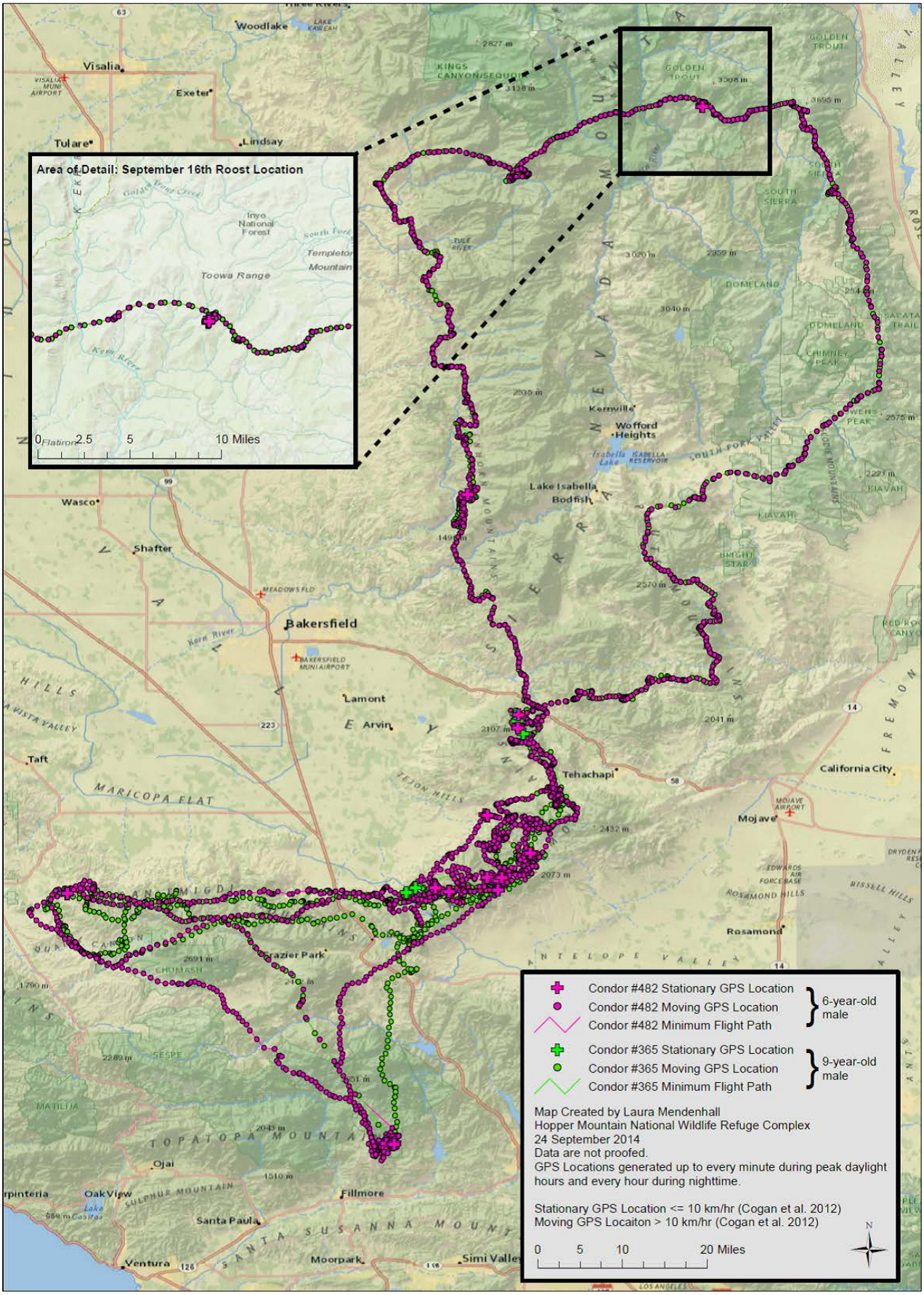


Figure 3.1.5: Exceptional flight by condors #482 and #365**.** In September of 2014 these two flew into Inyo county then north along the Eastern Sierras and crossed the Pacific Crest into Tulare County 17 miles south of Mount Whitney

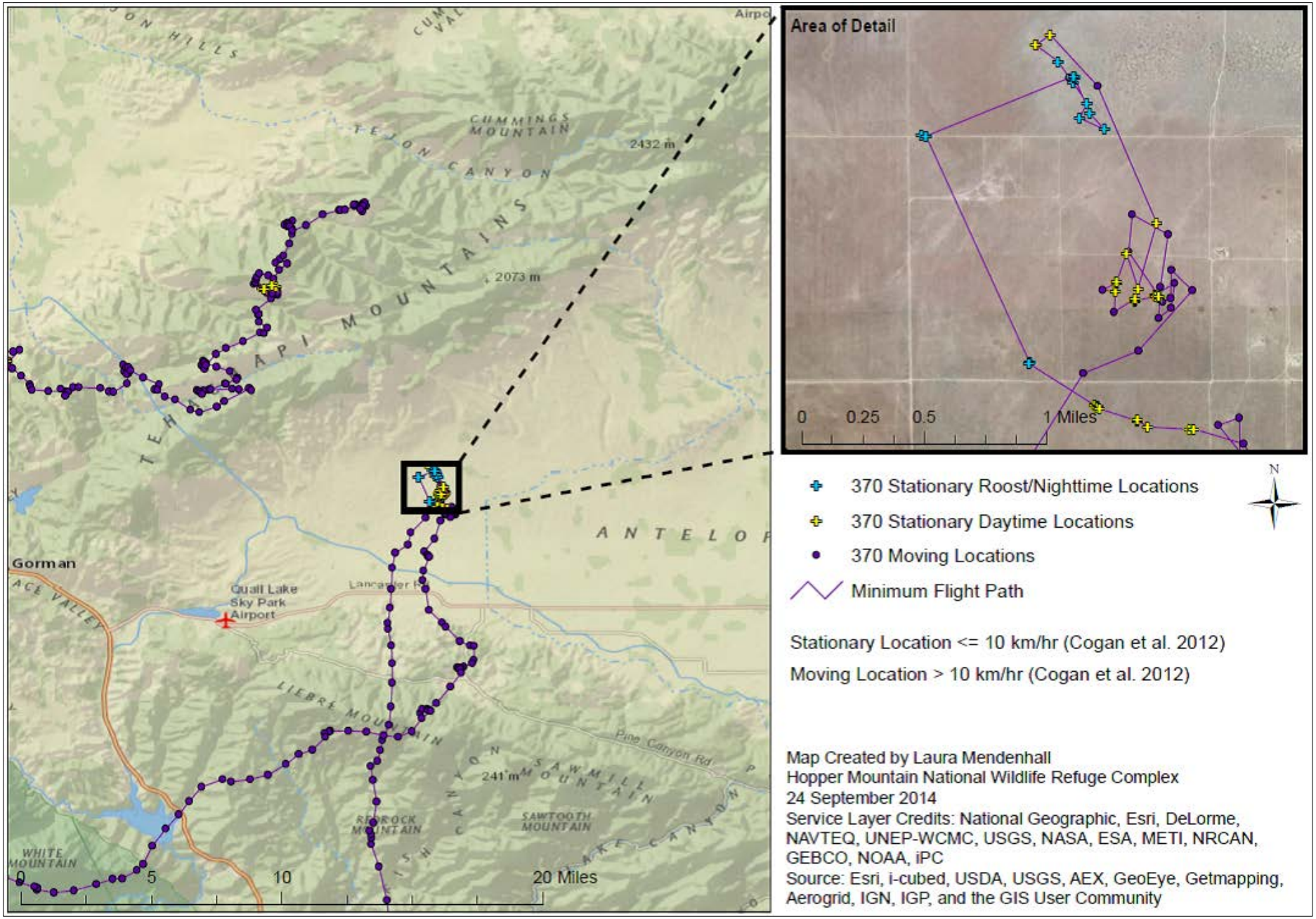


Figure 3.1.6: Exceptional flight by condor #370**.** In September of 2014 condor #370 roosted in the flats of the Antelope Valley about 5miles north of Lancaster Road (CA-138).

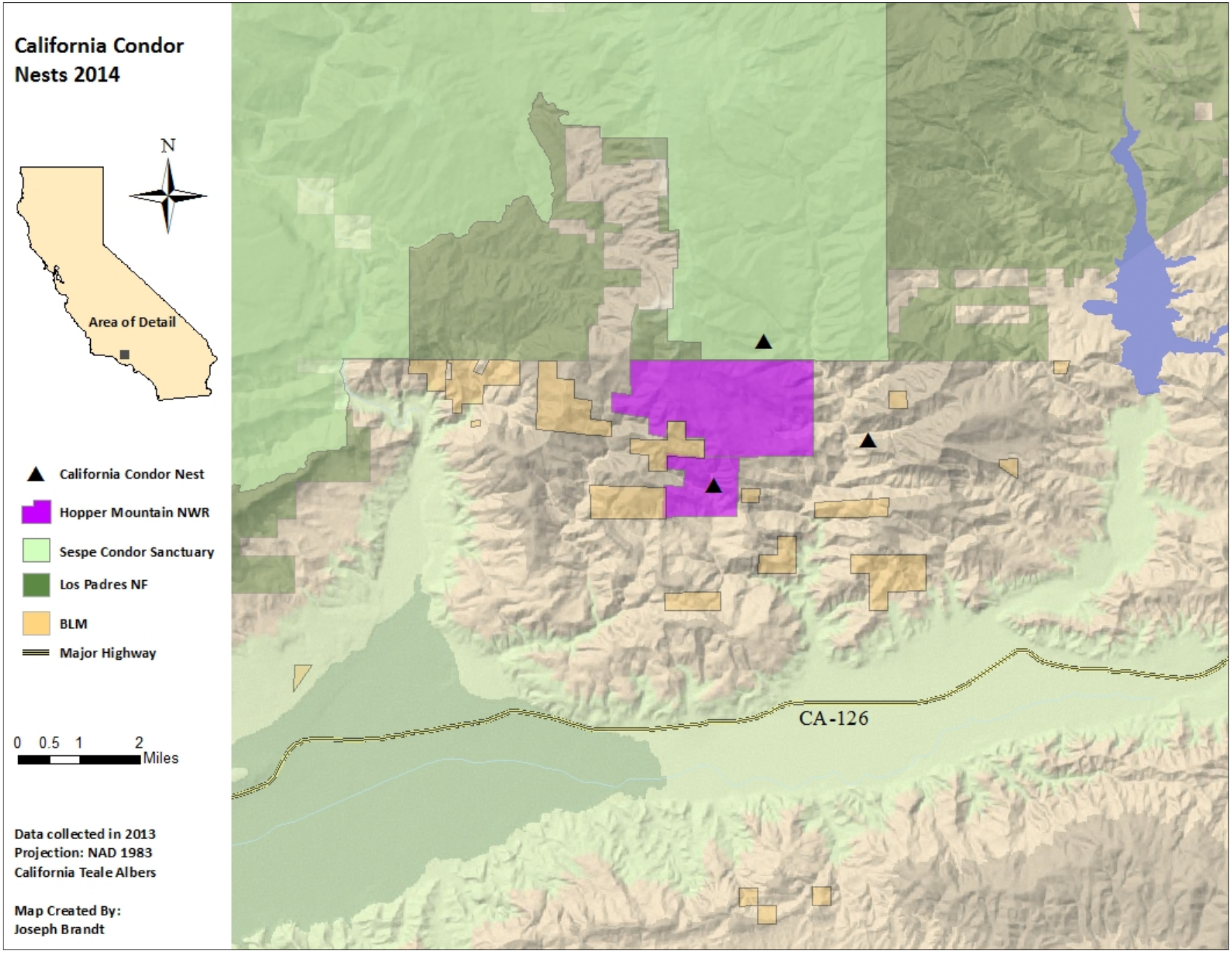


Figure 3.1.7: Locations of condor nests in 2014 (n = three nests).

3.2 Lead Monitoring and Mitigation

Sixty-three of 70 condors were trapped in 2014 (Table 3.2.1). There were 70 trappable condors in 2014. This differs from the end of year population size (66 condors) because of the change in population size throughout the year. In total, the field team handled condors 102 times, not including chicks and pre-release condors. Each trapping season normally lasts two months, June and July in the summer and November and December in the fall. As a result of the predator activity at Bitter Creek NWR in November and low staffing levels, the start of the fall trapping season was delayed until December and trapping was only conducted at Hopper Mountain NWR. This resulted in low trapping success in the fall and a trapping effort that continued into January of 2015. Service field team members and volunteers spent approximately four to five days per week in a blind trapping during each season. The field team handled condors on a weekly basis with each condor requiring about 30-45 minutes of handling time and, depending on the number of condors, between two to 15 people assisting at each handling event.

The field team transported 10 individual condors to the Los Angeles Zoo for 12 chelation treatments in 2014 (using the treatment threshold of 35 µg/dL on the field test kit). Of the 10 treated condors, two condors, #487 and #489, received chelation treatment on two separate occasions. There were no known lead related condor deaths in the Southern California population in 2014.

Using the criteria of greater than or equal to 10 µg/dL for exposure (Cade 2007), 61 condors out of the 63 tested had blood lead levels above background levels in 2014. This represents 96% of the population.

Table 3.2.1: Comparison of condors trapped between seasons and in total for 2014. The number of condors to be trapped reflects the number of wild condors in the population that are scheduled to be trapped for each season. Condors that are newly released in the fall are typically not re-trapped during the fall trapping season.

Season	Number of Condors to be trapped	Number of Condors Trapped	Percentage of condors trapped
Summer	70	60	86%
Fall	68	14	21%
2014	70	63	90%

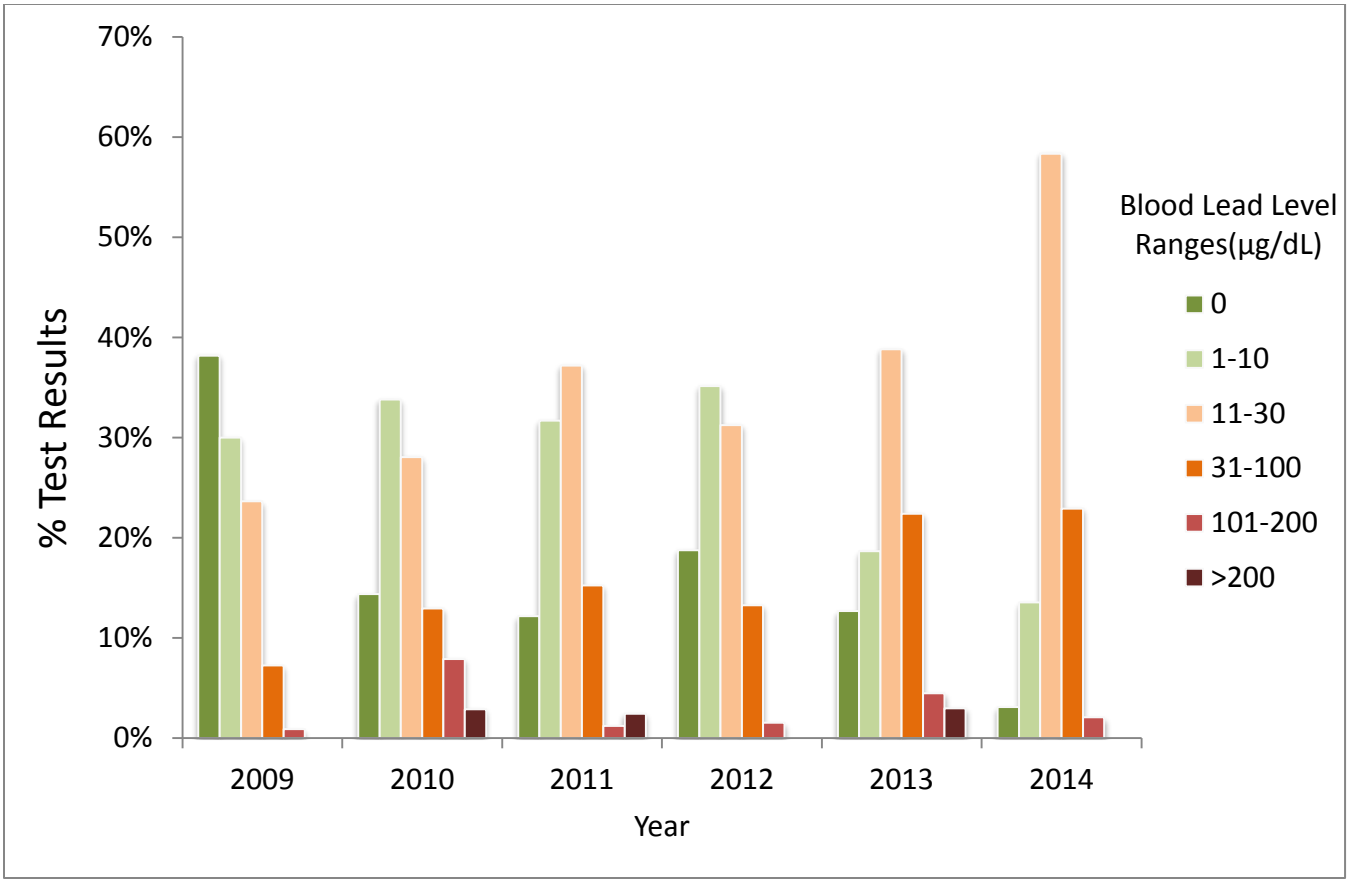


Figure 3.2.1: Summary of condor blood lead levels from 2009-2014. All of the lead values given represent lab blood lead values. Values returned as "not detected" are indicated by zero. Number of tests performed on the Southern California population of condors each year represented as "n" for each year.

3.3 Detecting Mortalities

Eleven free-flying condors died in Southern California during 2014 (Table 3.3.1). Seven condors died of predation, one condor died of unknown trauma, one condor is missing in the wild and presumed dead, and one condor died of an undetermined cause due to advanced decomposition and scavenging. The field team spent 30 to 40 hours each week attempting to detect the VHF signal of each condor in order to monitor for mortalities.

Juvenile condor #632 went missing in the wild with last detection via VHF signal on February 7, 2014. The last visual of #632 was on January 25, 2014 at the Bitter Creek NWR flight pen. Without the carcass, the cause of death remains unknown.

Adult male condor #125 was found dead inside the Hopper Mountain NWR flight pen. Upon entering the flight pen, field team members observed a bobcat in the flight pen. The bobcat was chased from the flight pen and observed to exit via a small hole between the edge of the flight pen fence and the building. Postmortem examination confirmed injuries consistent with predator trauma inflicted by the bobcat (see: Discussion). (Necropsy Report #14-000195).

Condor #645 was a juvenile captive reared condor that was being held in the Bitter Creek NWR flight pen prior to her scheduled released into the wild later in the fall of 2014. On the evening of August 29, 2014, condor #645 was reported to have been out of sight in a faux nesting box in the flight pen during a scheduled 4-hour monitoring session. This behavior is not unusual, but can be

indicative of an injury or behavioral concern with a condor. The following morning, a biologist observed condor #645 on the ground of the flight pen and unable to stand for longer than one to two seconds. She was placed in a kennel and transported to Los Angeles Zoo for veterinary examination, but was dead upon arrival. The cause of death was determined to be a bacterial infection (Necropsy Report #14-000234).

Five condors died from predation near a roost site on Bitter Creek NWR and adjacent property during fall 2014. Four of the condors were captive releases and killed within 18 days: adult male condor #63 and juvenile condors #637, #639, and #658. Condors #639 and #695 had been released into the wild for the first time approximately one week prior to their death while condors #63 and #637 had been in the wild for three years and one year respectively. Initial surveys of the scene and postmortem examinations revealed that all had succumbed to predation by bobcat (Necropsy Reports #14-000265, #14-000268, #14-000272, and #14-000282). As a result of these deaths, the Service requested assistance of the United States Department of Agriculture Wildlife Services program to trap and remove the bobcat responsible for the predations. For more information on the 2014 predator management effort at Bitter Creek NWR and the adjacent Bureau of Land Management lands (see Appendix II). A fifth deceased condor, wild fledged condor #658, was located on November 21, 2014 by Service and partner Santa Barbara Zoo staff in the same general area as the other four condors. The cause of death was determined to be trauma associated with bobcat predation (Necropsy Report #14-000311).

Condors #734 and #750 were chicks from a wild-laid and captive egg, respectively, that died near their nest cavity shortly after fledging. The scavenged remains of condor #734 were located below its nest cavity by field team and Santa Barbara Zoo staff after volunteer nest observer noticed its absence during a two-hour afternoon observation and reported a mortality signal in the direction of the nest vicinity (Photo 3.3.1). The cause of death was of unknown trauma (Necropsy Report #14-000285).

Photo 3.3.1: Biological Science Technician, Josh Felch collecting the remains of condor #734. Photo *Credit: Devon Pryor , Santa Barbara Zoo.*

Condor #750 was not visually observed since its fledging in early October, but VHF signals indicated that it was moving about the nest canyon area. A volunteer nest observer detected a mortality signal from condor #750's VHF transmitter on October 30, 2014. This condor was found deceased in a draw near its nest cavity by a biological science technician. Postmortem examination determined that condor

#750 died of predation related injuries (Necropsy Report #14-000293).

The heavily scavenged remains of juvenile condor #643 were located in the Santiago Canyon drainage near Bitter Creek NWR by Service field team members in early December. The field team had detected both normal and mortality signals from the VHF transmitter attached to condor #643 since mid-November which can be explained by the remains being scavenged. Due to the extensive scavenging and postmortem decomposition, the cause of death is undetermined (Necropsy Report #14-000335).

Table 3.3.1: California condor mortalities in 2014. Nine of these condors were died while in the wild. Two of those nine were just released into the wild (#639 and #695) and two were newly fledged chicks from wild nests (#734 and #750). Two, #125 and #645 died while captive in a refuge flight pen.

Studbook ID	Sex	Hatch Date	Mortality Date	Cause of Death	Location of Death
63	Male	08-May-91	28-Sep-14	Trauma - predation, bobcat	Bitter Creek NWR
125	Male	02-Jun-95	18-Jul-14	Trauma - predation, bobcat	Hopper NWR flight pen
632	Female	21-Jun-11	8-Feb-14	Unknown - missing the the wild	Unknown
637	Male	15-Mar-12	9-Oct-14	Trauma - predation, bobcat	Near Bitter Creek NWR, BLM property
639	Female	26-Mar-12	12-Oct-14	Trauma - predation, bobcat	Near Bitter Creek NWR, BLM property
643	Male	02-Apr-12	15-Oct-14	Undetermined - advanced decomposition	Near Bitter Creek NWR, Santiago Canyon drainage
645	Female	18-Apr-12	30-Aug-14	Bacterial infection	En route to Los Angeles Zoo
658	Male	27-Apr-12	20-Nov-14	Trauma - predation, bobcat	Near Bitter Creek NWR, BLM property
695	Male	01-May-13	16-Oct-14	Trauma - predation, bobcat	Near Bitter Creek NWR, BLM property
734	Male	06-Apr-14	15-Oct-14	Unknown trauma	Near Hopper Mtn NWR, below nest cavity in Los Padres NF
750	Male	25-Apr-14	29-Oct-14	Trauma - predation	Near Hopper Mtn NWR, nest area on private property

3.4 Nest Management

The 2014 nesting season spanned over nine months, with nests active from February until October. There were three active nests during the season, compared to seven in 2013, and all three fledged chicks (Table 3.4.1). An active nest is defined as any pair or trio of birds which produce at least one egg. Four established pairs that fledged chicks in 2013 did not nest this season and there were no new breeding pairs.

The SP14 nesting attempt involved two females, #79 and #156, and a male, #247. While not common, nesting attempts involving trios have been observed since 2001. Condor # 79's egg was laid on March 3, 2014. Condor #156's egg was never observed but based on her behavior she laid an egg March 21, 2014. Condor #247, who had been observed copulating with #156, was not observed near the #156's cavity and she eventually abandoned after about 30 days.

Nest guarding has proven effective at increasing the number of wild-fledged chicks in the Southern California population. Nesting success, defined as the total number of chicks to fledge out of the total number of nests, has increased dramatically since nest guarding was implemented across all nests in 2007 (Figure 3.4.1).

Table 3.4.1: Nesting attempts and outcomes for the 2014 breeding season. Sire Studbook Number is the studbook number of the male attending the nest. Dam Studbook Number represents the studbook number of the female attending the nest. Foster Eggs are captive laid eggs used to replace the wild laid egg when it was not viable. Chick Studbook number is the studbook number of the chick that hatched in the wild nest.

Nest Identification	Date Nest Located	Sire Studbook Number	Dam Studbook Number	Egg Identification	Lay Date	Foster Egg Used	Foster Egg Identification	Date Hatch	Chick Studbook Number	Number of Nest Entries	Nest Fate
TC14	13-Feb	374	180	FW114	2-Feb	N	NA	31-Mar	733	4	Fledged on 03-Oct
KR14	13-Feb	125	111	FW214	8-Feb	N	NA	6-Apr	734	5	Fledged on 05-Oct
SP14	5-Mar	247	79	FW314	3-Mar	Y	14KENS1	25-Apr	750	5	Fledged on 07-Oct
SP14*	3-Apr	247	156	FW414	21-Mar	N	NA	NA	NA	0	NA

** SP14 was a trio with two females and one male. The second female attended a second cavity and is suspected to have laid a second egg which did not hatch and was not recovered.*

In 2014, each nest was monitored over the course of the season using direct observation and periodic nest entries. Nest cameras were used for monitoring two of the nests, TC14 and KR14. Both cameras were installed during the hatch confirmation of the egg in each nest.

Nests were directly observed for a total of 187 hours over 62 observer days. Unpaid volunteer nest observer hours accounted for just over a third of all observation hours (Table 3.4.2). Each week observers spent two to three days reviewing nest camera footage. About 90 days were spent reviewing nest camera footage. In that period roughly 2200 hours of nest camera footage was reviewed.

Nest cameras allow observers to review 14 hours of nesting activity for every hour of watching nests directly because of the ability to speed up the video during times of inactivity. Nest cameras record during all or most of the daylight hours, which allows them to capture infrequent events that are often missed by less comprehensive direct observations. The level of detail is also greatly increased because of the proximity of the camera to the egg, chick, and/or parents.

The field team performed 14 nest entries over the course of the year. Each entry required two to four personnel for eight to twelve hours. Los Angeles Zoo staff provided assistance on one of these nest entries. Far fewer nest entries were conducted than in previous years because of the low number of nests and the decreased staffing levels. Normally, the chick is examined four times during the chick stage. Two chicks were examined three times and the third was only examined twice. The nest cameras were helpful in ensuring the chicks were developing properly in spite of the fewer nest entries conducted.

Only a single intervention was required in 2014. Egg, FW314, at nest SP14 was found to be nonviable during routine nest entry. It was replaced with dummy egg during the fertility check and then a hatching captive egg, 14KENS1 from the World Center of Birds of Prey, was placed in the nest 26 days later. The captive egg was first transported to the Los Angeles Zoo prior to placement into the wild nest.

In addition to interventions, a number of preventative measures were also taken at nests. The field team vaccinated chicks for West Nile virus during nest entries. The substrate of each nest was sifted for microtrash. All three nests in 2014 though the amount of trash was less than previous years (Table 3.4.3).

Table 3.4.2: Nest observation hours by personnel type.

Personnel Type	Observation Hours
Service Staff	8
Santa Barbara Zoo Staff	45
Volunteer Interns	65
Unpaid Volunteers	69
Total Observation Hours	187

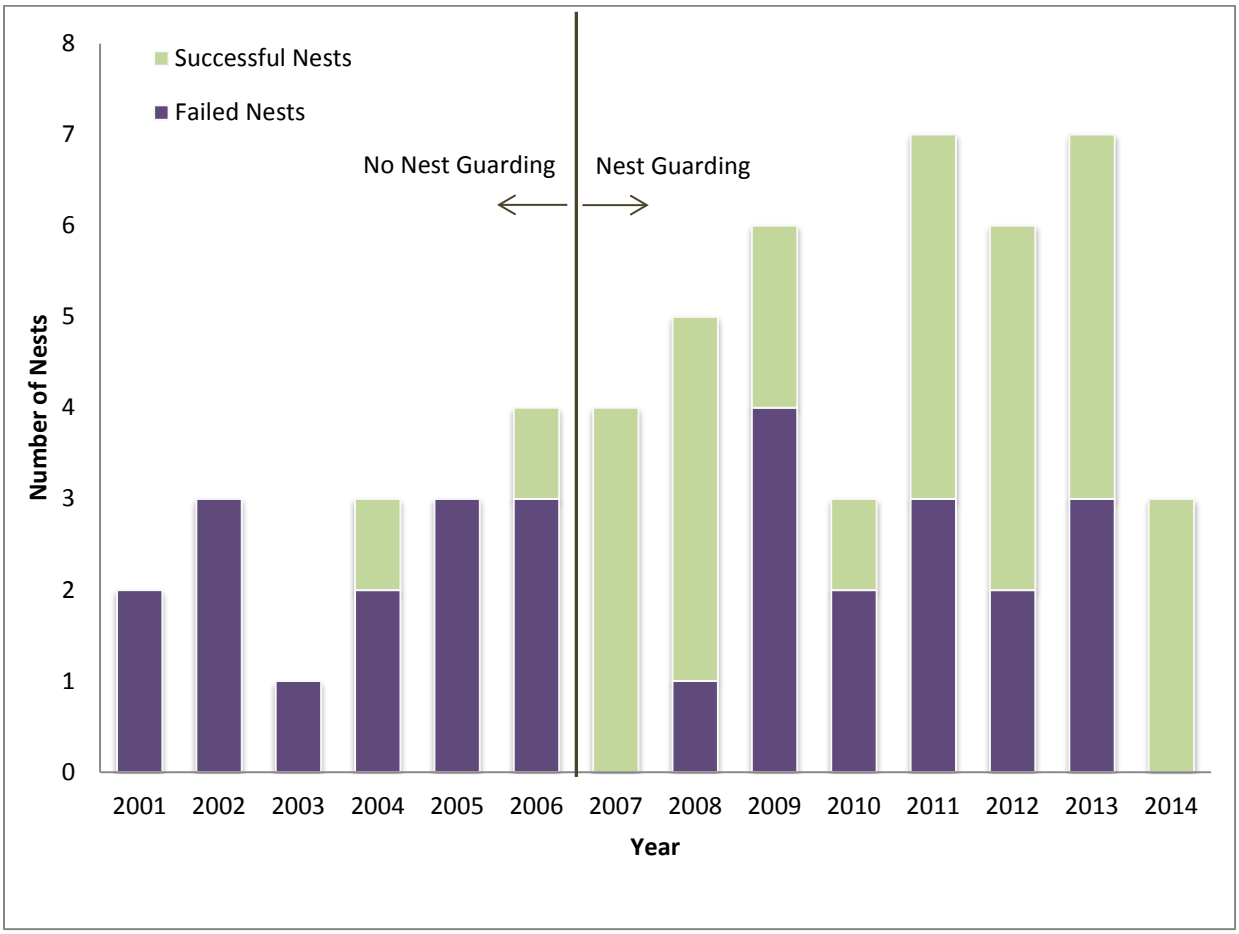


Figure 3.4.1: Nesting success before and after implementation of Nest Guarding Program. Nests are defined by pairs or trios of condors that produce at least one egg. Nesting success is any nest where a chick fledges from the nest.

Table 3.4.3: Microtrash recovered from nests during 2002-2014 seasons. Values represent the total number of trash items collected from each nest or associated chick each year (*Nest failed prior to the chick being 90 days of age, value was not included in the average or nest count).

Nest	Year												
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AB	-	-	143	321	1*	233	-	60	-	3*	-	167	-
DG	-	-	-	-	-	38	-	52	32*	-	31	-	-
HB/SP	-	-	-	-	-	-	0	?*	-	10	1	31	21
HC	20	-	?	-	46	19	26	103	-	55	-	55	-
HW	86	-	-	-	-	-	-	-	-	-	-	-	-
HW/3C	-	-	-	-	-	-	322	12*	-	-	-	-	-
KR	0	44	53	41	-	43	11	10*	26	3	9*	153	16
LC-PC	53	-	-	-	-	-	-	-	-	-	-	-	-
LP	-	-	-	5*	-	-	-	-	-	-	-	-	-
OD	-	-	-	-	-	-	-	-	-	-	-	0	-
PC[1]	-	-	-	-	48	-	115	-	-	-	-	-	-
PC[2]	-	-	-	-	-	-	-	-	-	32	-	51	-
SC	-	-	-	-	-	-	-	-	-	21	1*	3*	-
GF	-	-	-	-	-	-	-	-	-	0*	-	-	-
RC	-	-	-	-	-	-	-	-	-	-	3	-	-
TC	-	-	-	-	-	-	-	-	-	-	71	-	49-
Average	40	44	98	184	48	95	95	72	26	24	27	76	29

3.5 Captive Releases and Transfers

In 2014, the field team did not successfully release any new captive bred California condors (Table 3.5.1). A total of ten condors, including a condor that was previously wild in the 1980s (#20), were intended for release by the Service during the months of October and November. Releases were canceled for the season as a result of a high rate of predation on newly released birds at Bitter Creek NWR (for more information see: Detecting Mortalities and Discussion). Prior to release, these condors were held in the flight pen at Bitter Creek NWR starting in June.

A total of 19 condors meant for release into the wild were transported to the Bitter Creek NWR flight pen in 2014. Nine of these condors were intended for release in Central California and Baja California, Mexico, and were being held temporarily at Bitter Creek NWR. Six pre-release condors from Oregon Zoo were transferred to the refuge via a flight donated by Fed-Ex in June. Two condors were transferred from the Los Angeles Zoo. Condor #603 came from Los Angeles but had hatched from a wild nest at Pinnacles National Park and was injured prior to fledge and brought to the Zoo for rehabilitation. Nine condors were transferred to Bitter Creek NWR from the World Center of Birds of Prey in Boise, ID in September. Three were flown from Boise on a flight donated by Lighthawk. The other six were transported by van by World Center of Birds of Prey staff. The final condor, #20, was brought to the Bitter Creek NWR from the San Diego Safari Park in late September.

During the six months pre-release condors were housed in the flight pen, the field team checked on their health daily and conducted additional, intensive four-hour observations two to four days a week. While held in captivity, these condors were given regular fresh food and water, which necessitated at least one person on duty daily at the Refuge at all times. One pre-release condor, #645, died while being held in the flight pen shortly after her transport (see Detecting Mortalities for further information).

The field team attempted to release four condors into the wild on October 9, 2014. Two of these condors, #639 and #695, were predated after three and seven days in the wild respectively. The other two newly released condors, #687 and #713, were re-trapped eight days after release. While these condors were in the wild, an average of two personnel closely monitored newly released condors every day, for approximately 10 hours each day (Table 3.5.2). The new releases that died were two of five birds lost to a predator at Bitter Creek NWR over a 60 day period starting in September and ending in November. The presence of a predator, determined to be a bobcat, taking condors at such a high frequency canceled any further attempts at releasing birds in 2014. The remaining birds were transported to program partners Central California (Pinnacles National Park and Ventana Wildlife Society) for eventual release. With the assistance of U.S. Department of Agriculture Wildlife Services, emergency predator control actions were conducted and the suspected offending bobcat was lethally removed (see Appendix II).

The low rate of wild reproduction, high number of mortalities, and lack of captive releases for 2014 resulted in an eight percent decrease in the Southern California population. This is the first time since 2001 that the flock in Southern California has decreased (Figure 3.5.1).

A number of condors from the Southern California population were also trapped and held for extended periods as a result of severe lead poisoning or other injuries. Condor #289 was trapped in September of 2013 and held at the Los Angeles Zoo due to severe lead toxicosis. After rehabilitation, she was held in the Bitter Creek NWR to serve as a mentor for the pre-releases in the fall and then released at Hopper Mountain on November 6, 2014 (Photo 3.5.1). Condor 480 was found with an injured wing of unknown origin in an oil field in Maricopa, CA north of Bitter Creek NWR on September 29, 2014. He was rehabilitated and released on November 6, 201

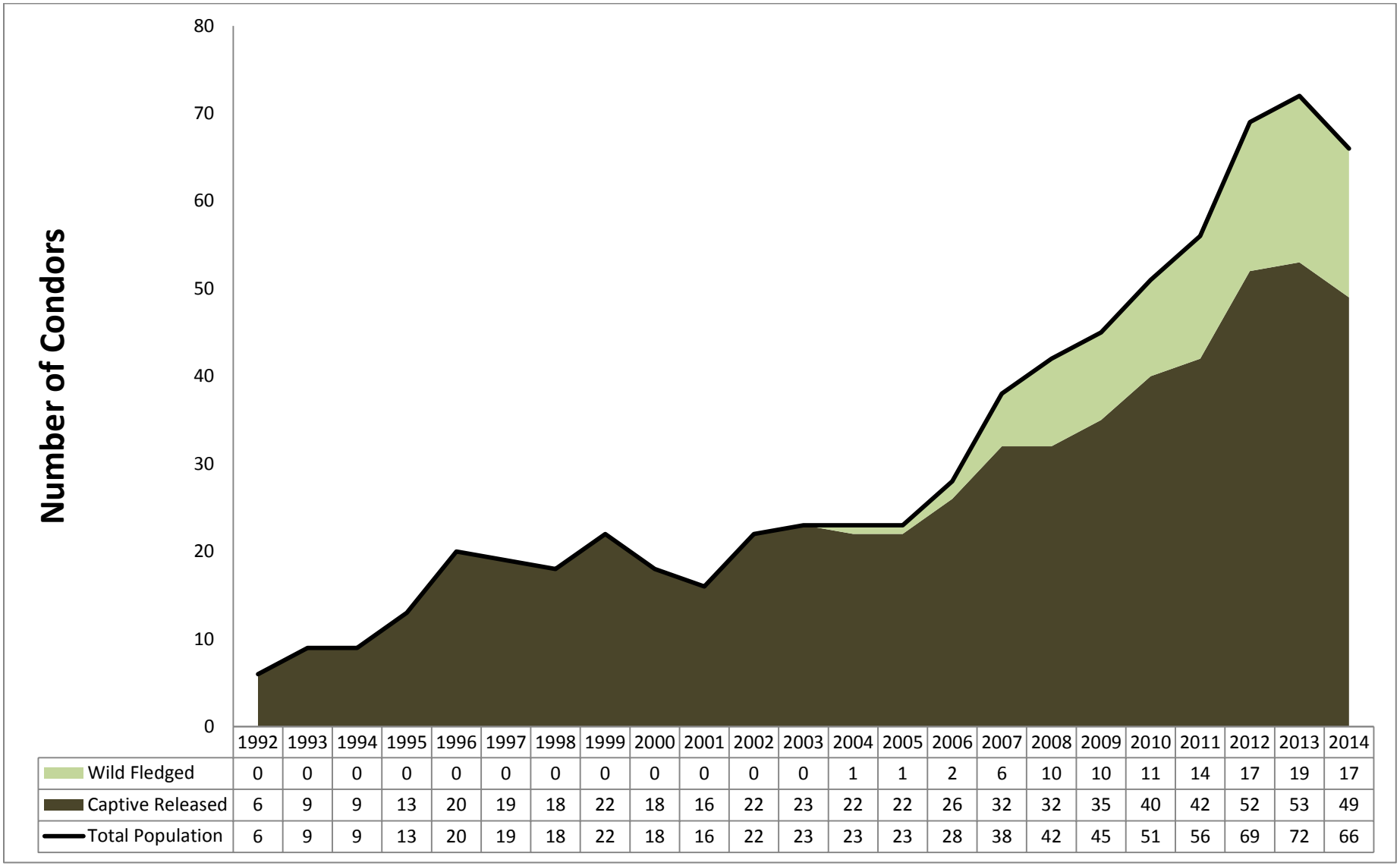
Photo 3.5.1: After a 15 month period in captivity being treated for severe lead toxicosis, condor #289 is released back into the wild at Hopper Mountain NWR. *Photo Credit: Louis Sahagon, Los Angeles Times*

Table 3.5.1: Pre-release condors held at the Bitter Creek NWR flight pen in 2014. SB# = Studbook #; SDZSP=San Diego Zoo Safari Park; WCBP=World Center for Birds of Prey; NA=not applicable. A successful fate indicates that the released condor was alive and remained in the wild population without having to be recaptured for 90 days following its initial release.

SB#	Sex	Hatch date	Hatch location	Transfer date	Release date	Fate	Age at Release (in years)
20	male	~1/1/1980	Wild California	29-Sep-14	na	na	na
603	female	9-Apr-11	Wild California	5-Sep-14	na	na	na
639	female	26-Mar-12	Oregon Zoo	22-Aug-14	9-Oct-14	Died	2.5
645	female	18-Apr-12	Oregon Zoo	22-Aug-14	na	na	na
684	female	11-Apr-13	Oregon Zoo	22-Aug-14	na	na	na
687	female	19-Apr-13	Oregon Zoo	22-Aug-14	9-Oct-14	Retrapped	1.5
688	male	22-Apr-13	Oregon Zoo	22-Aug-14	na	na	na
692	male	26-Apr-13	Oregon Zoo	22-Aug-14	na	na	na
695	male	1-May-13	Los Angeles Zoo	5-Sep-14	9-Oct-14	Died	1.4
696	male	30-Apr-13	World Center of Birds of Prey	13-Sep-14	na	na	na
697	male	30-Apr-13	World Center of Birds of Prey	13-Sep-14	na	na	na
700	male	3-May-13	World Center of Birds of Prey	13-Sep-14	na	na	na
703	male	4-May-13	World Center of Birds of Prey	13-Sep-14	na	na	na
704	male	17-May-13	World Center of Birds of Prey	13-Sep-14	na	na	na
706	male	11-May-13	World Center of Birds of Prey	13-Sep-14	na	na	na
711	male	20-May-13	World Center of Birds of Prey	13-Sep-14	na	na	na
713	male	23-May-13	Los Angeles Zoo	5-Sep-14	9-Oct-14	Retrapped	1.5
716	male	4-Jun-13	World Center of Birds of Prey	13-Sep-14	na	na	na
718	male	10-Jun-13	World Center of Birds of Prey	13-Sep-14	na	na	na

Table 3.5.2: Captive release efforts in 2014 at Bitter Creek NWR.

	January	February	March	April	May	June	July	August	September	October	November	December
Number of condors released	0	0	0	0	0	0	0	0	0	4	0	0
Approximate staff hours tracking new releases	0	0	0	0	0	0	0	0	0	144	0	0
Total number of calf carcasses provided	21	15	21	17	10	9	13	19	13	16	0	0



	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Wild Fledged	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	6	10	10	11	14	17	19	17
Captive Released	6	9	9	13	20	19	18	22	18	16	22	23	22	22	26	32	32	35	40	42	52	53	49
Total Population	6	9	9	13	20	19	18	22	18	16	22	23	23	23	28	38	42	45	51	56	69	72	66

Figure 3.5.1: Number of wild California condors from 1992 through 2014. The size of the population reported represents the number of condors in the Southern California flock at the end of each year (Dec 31).

3.6 Behavioral Modification

In 2014, condors visited seven general known areas of human development. Of these, the most frequented areas were the communities of Bear Valley Springs (BVS), Stallion Springs, and Alpine Forest Park in the Northern Tehachapi Mountains and a private inholding on Winter's Ridge of Tejon Ranch . Condors visited the other three developed areas: an oil pad near Lake Piru, ITT Towers on the Angeles National Forest, and a church, Rancho de la Cruz, near Bitter Creek NWR, much less frequently.

Due to limited resources, daily monitoring by field team personnel at the Northern Tehachapi Mountains communities was drastically reduced in 2014. The field team spent about 10 hours each week monitoring and hazing condors from private homes in the communities, educating residents, and providing assistance with automated hazing devices and other deterrents. The field team corresponded directly and frequently with the owners of the inholding on Tejon Ranch, providing both education and technical assistance.

The field team, in cooperation with the Friend's of the California Condor, Wild and Free, used outreach and education as the primary means of addressing behavioral modification in the Northern Tehachapi Mountains communities. Educational flyers were posted at the BVS Police Department, Post Office, and Bear Valley Market and distributed via the BVS Community Services District website, Stallion Springs Community Services District website, Alpine Forest Park Property Owner's Association website, community newsletters, and residents' mailboxes. The field team also fielded questions from concerned residents via regular phone calls and emails. An additional outreach event targeted BVS residents via a 4th of July educational booth.

Reports and observations of condors perching on power poles in BVS in 2013 prompted the Service to contact Southern California Edison (SCE) about possible electrocution of condors in the area. SCE scheduled a site assessment using information provided by the Service and determined retrofitting the power poles with covers would minimize the possibility of electrocution. This project was completed in January 2014. Many of the observed condors perching on power poles in BVS were wild fledged chicks, which impelled the field team to collaborate with SCE regarding the installation of life-sized mock power poles outside of the flight pens at Bitter Creek NWR and Hopper Mountain NWR. In August 2014, a crew from SCE and field team members installed these 30 foot tall mock power poles which serve as a means to train wild fledged chicks and reinforce the training in the rest of the flock (Photo 3.6.1).

Photo 3.6.1: The Service and a crew from SCE install a life-sized mock power pole outside of the Bitter CreekNWR flight pen. *Photo credit: Josh Felch, USFWS.*

3.7 Outreach

The field team educated the public during a variety of events and presentations in 2014 (Table 3.7.1 & Table 3.7.2). Field team members assisted the Institute for Wildlife Studies with their non-lead outreach booth at the Bakersfield Sportsman's Expo. The booth focused on providing sportsmen, sportswomen, and the general public information about making the switch to non-lead ammunition in the wake of the lead ammunition ban in California via the new law, Assembly Bill No. 711. In November of 2014, the Complex also provided an office space in their Ventura office for the Institute for Wildlife Studies' new non-lead outreach coordinator for Southern California.

A presentation at The Wildlife Society San Joaquin Valley Chapter's Natural Communities Conference described the current status of the Recovery Program's free-flying population and information regarding the release of captive condors in Southern California.

A field team member conducted two workshop sessions on endangered species conservation at the Student Climate and Conservation Congress at the National Conservation Training Center. The same field team member was interviewed for the Service's Conservation Connect webisode series regarding condor conservation.

Two events co-hosted with the Friends Group reached over 500 people. These events targeted local members of the public in an effort to foster condor conservation. One event was held at the Libbey Bowl in Ojai, California and featured a screening of the Condor's Shadow and guest booths by the Santa Barbara Zoo, Los Angeles Zoo, and the Ojai Raptor Center. The second event was a presentation to students at Sierra High School in Fillmore, California. Other Friends Group events included three tours for the general public at Hopper NWR, two tours at Bitter Creek NWR, an outreach booth at the Bear Valley Springs 4th of July Celebration, a condor outreach and viewing booth set up along Hudson Ranch Road adjacent to Bitter Creek NWR.

The field team led and assisted with eight tours of Hopper NWR and Bitter Creek NWR. The tour recipients included the Association of Zoos and Aquariums directors, Disney Conservation personnel, a reporter and photographer from the Santa Maria Sun and SLO New Times, the National Wildlife Federation, Publics Lands Day volunteers, Kern County Wildlife Resources Commissioners, and the general public.

The field team responded to media interviews about various aspects of condor conservation with the Santa Maria Sun, SLO New Times, and the L.A. Times. SCE published a story on the Edison Newsroom covering power pole aversion training and their collaboration with the Service (see Behavioral Modification section).

The Facebook page launched in 2012 in cooperation with the Santa Barbara Zoo called "The Condor Cave" increased its following by 113% with a total of 2,149 followers as of December 31, 2014.

Table 3.7.1: Outreach presentations given in 2014. FWCCWF = Friends of the California Condor Wild and Free; HMNWRC = Hopper Mountain National Wildlife Complex; NCTC = National Conservation Training Center; TWS SJVC = The Wildlife Society San Joaquin Valley Chapter.

Description	Location	Date
Wildlife Biologist Geoff Grisdale assisted with Institute for Wildlife Studies booth at Bakersfield Sportsman's Expo	Bakersfield, CA	Feb 28
Wildlife Biologist Geoff Grisdale assisted with Institute for Wildlife Studies booth at Bakersfield Sportsman's Expo	Bakersfield, CA	Mar 1
Biological Science Technician Josh Felch assisted with Institute for Wildlife Studies booth at Bakersfield Sportsman's Expo	Bakersfield, CA	Mar 2
Wildlife Biologist Geoff Grisdale presented at TWS SJVC Natural Communities Conference	Bakersfield, CA	Mar 27
Supervisory Wildlife Biologist Joseph Brandt conducted two workshop sessions on endangered species conservation at the Student Climate and Conservation Congress	National Conservation Training Center, Shepherdstown, WV	Jun-26
Supervisory Wildlife Biologist Joseph Brandt interviewed for FWS Conservation Connect webisode at NCTC	National Conservation Training Center, Shepherdstown, WV	Jun 27
HMNWRC and FCCWF co-sponsored the event: An Evening with the California Condor which featured a screening of the Condor's Shadow and guest booths by Santa Barbara Zoo, Los Angeles Zoo, and Ojai Raptor Center	Libbey Bowl, Ojai, CA	Jul 18
Great Basin Institute Research Associate Stephanie Herrera participated in FCCWF presentation to high school students	Sierra High School, Fillmore, CA	Dec 18

Table 3.7.2: Outreach tours performed in 2014. BCNWR=Bitter Creek NWR; HMNWR=Hopper Mountain NWR; UCSB=University of California Santa Barbara.

Description	Location	Date
Supervisory Wildlife Biologist Joseph Brandt and wildlife biologist Laura Mendenhall assisted with a tour of HMNWR with the Santa Barbara Zoo for Association of Zoos and Aquariums directors.	Hopper Mountain NWR	Jan 23
Biological Science Technician Devon Pryor assisted with tour of HMNWR for Disney Conservation personnel	Hopper Mountain NWR	Jan 25
Supervisory Wildlife Biologist Joseph Brandt conducted tour of BCNWR for a reporter and photographer from the Santa Maria Sun and the SLO New Times	Bitter Creek NWR	Mar 19
Supervisory Wildlife Biologist Joseph Brandt and wildlife biologist Laura Mendenhall conducted condor work up with Beth Pratt of National Wildlife Federation and John Myatt and Cindy Sandoval of Regional Office in attendance (filmed)	Hopper Mountain NWR	Jun 24
Wildlife Biologist Geoff Grisdale assisted with tour of HMNWR for general public	Hopper Mountain NWR	Jul 18
Wildlife Biologist Geoff Grisdale assisted with tour of HMNWR for general public	Hopper Mountain NWR	Aug-15
Wildlife Biologist Laura Mendenhall and Intern Leah Harper assisted with tour of BCNWR for Public Lands Day volunteers	Bitter Creek NWR	Sep 27
Supervisory Wildlife Biologist Joseph Brandt and wildlife biologist Laura Mendenhall prepare four condors for release with Kern County Wildlife Resources Commissioners	Bitter Creek NWR	Oct 8

4.0 Discussion

Staffing

The Hopper Mountain National Wildlife Refuge Complex condor field team experienced a significant loss of staff, and thus capability, in 2014. In February 2014, a term biological technician was not extended and remains vacant. In September 2014, a term wildlife biologist could not be extended because it reached the maximum time allowed as a term position (four years). The position remained vacant through the end of 2014. In November of 2014, the second wildlife biologist position was vacated when the person in this position took a higher graded position elsewhere. Losing the individuals in these three positions amounted to losing 18 years of combined experience directly related condor management.

Eliminating a position combined with the regular turnover of term employees affected the field team's ability to implement recovery actions. The current structure (i.e., reliance on term employees) of the field team makes the field team susceptible to a high rate of staff turnover and reduces the programs ability conducting field activities, managing data, generating reports, and assisting with other recovery program needs.

The Service's reliance on term employees also affects the field team's continuity of operations. Many of the activities conducted by the field team require highly specialized skills, institutional knowledge, and personal relationships, which take years to develop.

Monitoring Resource Use

The field team replaced all Argos GPS transmitters with two types of GSM GPS transmitters. While Argos GPS units reliably transmit data from almost any location each day, they only collect 10 to 14 locations (once every hour) and have high data fees (approximately $90 per month per transmitter). The GSM transmitters require cell service to transmit the data, but are able to collect locations at a much higher frequency (once location ever two to 15 minutes) and data fees are a third the cost of the Argos transmitters. Unlike the Argos transmitters, the GSM transmitters cannot be used to help identify and locate mortalities because they often do not transmit data while on the ground in remote locations. However, the GSM transmitters provide much greater detail on condor movements and habitat use, which is the primary purpose of placing GPS transmitters on condors. Mortalities are primarily identified using the VHF transmitters which condors wear in addition to a GPS transmitter.

Transitioning to new GPS units also required additional GPS transmitter data management needs. These needs were met in cooperation with the Fort Collins USGS office through a Science Support Partnership project titled: Improve Wildlife Species Tracking-Implementing an Improved GPS Data Capture, Delivery, and Archive System

for California Condors. A detailed description of this project is described in detail in Appendix IV. The results of the project improved condor GPS transmitter data management and proofing for not only the Southern California population, but also for our partners in Central California, Ventana Wildlife Society and Pinnacles National Park, and standardized the data management and proofing process at all three release sites in California.

Lead Monitoring and Mitigation

The 2014 trapping effort was the second consecutive year where all condors in the Southern California population were not trapped. As the condor population expands in range, individual condors spend less time near trap sites and become more difficult to trap. This trend is likely to continue and in order to maintain trapping success an additional trap site in the Tehachapi Mountains should be considered.

Detecting Mortalities

Identifying and understanding causes of mortality is a critical component of condor recovery. The inability of the field team to trap the entire free-flying condor population for a second consecutive year had direct implications on the Service's ability to detect mortalities. Maintaining VHF transmitters on each condor is essential to the task of finding and recovering dead condors and cannot occur without the regularly trapping the entire population.

Captive releases and Transfers

The five condor mortalities resulting from bobcat predation at Bitter Creek NWR had a significant impact on field activities. These deaths accounted for half of the deaths in the Southern California condor population and prevented captive releases which are needed to increase the population. This event in 2014 was the second instance where a predator has selected condors as prey at an alarming rate. In this case, the predator was a bobcat. In 2010, the predator was a mountain lion and three condors were lost in a period of 32 days. In both cases, the ability to respond to the incident was prevented or delayed because of the need to consider environmental impacts and navigate state regulations. A condor predator management plan would allow the field team to respond the threat of a predator targeting condors more quickly and reduce mortality and decrease the impact on condor field activities that are required to achieve recovery.

The loss of a condor to a bobcat at the Hopper Mountain NWR flight pen also prompted a review of the husbandry protocols and inspection of the facilities for the Complex (Appendix III). That review concluded that, without improvements, the flight pen at Hopper Mountain NWR should not be used to hold condors and the security of both flight pens can be improved. These improvements will require outside resources to assist with design and construction of improved facilities.

Outreach

In October of 2014, the Institute for Wildlife Studies hired a Non-lead Outreach Coordinator for the Southern California Region. This position is located at the Hopper Mountain NWRC office in Ventura and will lead all non-lead outreach efforts in Santa Barbara, Ventura, Los Angeles, and Kern Counties with the support of the field team when needed. This is the first time the Southern California Region has had a position dedicated to non-lead outreach. These outreach activities are fund from contributions made by Alta Windpower Development, LLC as part of the avoidance, minimization, and mitigation program for the condor that was identified in the Bureau of Land Management's final environmental impact statement (Bureau 2013) and the biological opinion (U.S. Fish and Wildlife Service [Service 2013a]) for the Alta East wind energy project.

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Appendix I Contributions to Ongoing Research

Data collected over the course of 2014 will contribute to ongoing research within the Service, various universities, and other federal agencies. Examples of this ongoing research include:

Species Tracking Optimization: Pilot Test of an Improved Capture and Delivery of California Condor Location Information
Years: 2013-2014

Study Objective: Alternatives for monitoring wildlife populations now exist that can significantly improve wildlife monitoring and management. Projects have the potential to track and alert in near real time wildlife mortality, track sick or injured wildlife, implement location-aware alerts (termed geofencing), and enable users to access these data though traditional desktop computing and mobile environments (e.g. smartphones). This proposal is investigating new and emerging technologies that will improve condor science and management.

Principle Researchers: David Douglas, Robert Waltermire, Tim Kern, and Chris Emmerich from USGS; Gil Bohrer, Rolf Weinzerl, and Sarah Davidson from Movebank.org; Richard Kearney, Pat Lineback, Joseph Brandt, and Laura Mendenhall from USFWS; Andrew McGann from Cellular Tracking Technologies, LLC.

Sponsor: U.S. Fish and Wildlife Service, U.S. Geological Survey, Movebank.org

Funding Source: Science Support Partnership Fund

Results to Date: Development of a new GPS data model; manufacture of a custom GSM unit, progress on establishing a condor daily map using data from FISMA-compliant repository.

Anticipated Completion: September 2014

Genetic map and whole genome sequences of California condors
Years: 2006-present

Study Objective: Utilize robust genetic and genomic approaches, construct a complete genome-based database of genetic variation in California condors, and make findings available for population management and recovery. Anticipated findings include: detailed analysis of kinship among founder California condors, detailed characterization of variation at the single nucleotide polymorphism (SNP) level, assessment of retention of genetic variation in the species pedigree, identification of the mutation causing chondrodystrophy, identification of carriers of chondrodystrophy allele.

Principal Researchers: Oliver A. Ryder, Stephan C. Schuster (P.I.), Webb Miller, Michael Romanov.

Sponsor: U.S. Fish and Wildlife Service California Condor Recovery Program, San Diego Zoo Global.

Funding Source: San Diego Zoo Global, Seaver Institute, John and Beverley Stauffer Foundation, other private foundations.

Results to Date: A genetic map for California condors based on comparison to chicken and zebra finch genomes has been published. A microsatellite-based linkage map is in development. Sequencing of 30 California condor genomes utilizing Illumina technology has been proposed and funding is pending. This study would identify all extant genetic variation at the nucleotide level and affords the opportunity to identify the mutation associated with heritable chondrodystrophy.

Anticipated Completion: If current funding proposals are approved, the reference genome and initial descriptions of species variation would be completed within one year. More detailed analyses of demography and evolutionary population genetics would follow. Priority will be given to reporting recovery-relevant findings.

An assessment of the biological impact of contaminants and management actions that influence the long-term persistence of the California condor
Years: 2011-2016

Study Objectives: Synthesize existing data and collect new data on the risks of contaminant exposure to California condors. We will also identify the suitability of existing and proposed future habitat with respect to changes in contaminant exposure, human demographics, and climate. Quantify baseline measures of individual condor performance (e.g., survival, reproductive success) and how these rates are influenced by the effects of contaminants (e.g., lead, organochlorines, microtrash) and future habitat suitability from changes in human demographics, climate. Develop demographic modeling approaches for each condor population in California that allows estimation of how contaminants, global climate change, future habitat suitability, and management efforts will impact population recovery.

Principal Researchers: Donald R. Smith, Daniel F. Doak, Myra Finkelstein, Vickie Bakker
2012 HMNWRC California Condor Recovery Program Annual Report 35

Sponsors: Department of Environmental Toxicology University of California, Santa Cruz; US Fish & Wildlife Service, Hopper Mountain NWRC, National Park Service, Pinnacles National Monument; US Geological Survey, Forest and Rangeland Ecosystem Science Center; US Fish &

Wildlife Service Water Pollution Control Laboratory CA Dept. of Fish and Game, Office of Spill Prevention and Response; University of Wyoming, USFWS Ventura Ecological Service Office

Funding Sources: Montrose Settlement Restoration Funds, USFWS Environmental Contaminants Program On-Refuge Investigations Sub-Activity

Anticipated Completion: 2016

Eggshell thinning and depressed hatching success of California condors reintroduced to Central California.
Years: 2006-2015

Study Objective: Compare condor hatching success and eggshell thickness between reintroduced populations of California condors in Central and Southern California. Evaluate the cause of egg failure in wild laid eggs and assess the potential sources of organochlorine contamination and determine its impact of the condor population in Central California.

Principal Researchers: Joe Burnett, Kelly Sorenson, Joseph Brandt, Bob Risebrough

Sponsors: Ventana Wildlife Society, US Fish & Wildlife Service Hopper Mountain National Wildlife Refuge Complex, The Bodega Bay Institute, Los Angeles Zoo and Botanical Gardens, Santa Barbara Zoo.

Funding Source: Ventana Wildlife Society and USFWS Hopper Mountain NWRC

Results to date: Burnett et al. 2009 (presentation); Burnett, L. Joseph, Kelly J. Sorenson, Joseph Brandt, Estelle A. Sandhaus, Deborah Ciani, Michael Clark, Chandra David, Jenny Schmidt, Susie Kasielke, and Robert W. Risebrough. 2013. Eggshell Thinning and Depressed Hatching Success of California Condors Reintroduced to Central California The Condor 115 (3), 477-491

Anticipated Completion: 2015

California condor Nest Guarding Project
Years: 2007- 2016

Study objective: Analysis of nest success in Southern California's reintroduced population of California condors along with the trends of breeding effort and nest success within this population in response to changes in foraging, demographics and management strategy (tentative plan).

Principal Researchers: Estelle Sandhaus and Joseph Brandt.

Sponsors: Santa Barbara Zoo; US Fish & Wildlife Service Hopper Mountain NWRC; Los Angeles Zoo.

Funding Source: Hopper Mt NWR base funds, SB Zoo base funds.

Results to date: 6% Nesting Success (2001-2006) increased to 60% nesting Success (2006-2011), Brandt et al. 2008 (presentation), Brandt et al. 2010 (poster), Sandhaus et al. (2012) Wynn & Stringfield 2011.

Anticipated completion: 2016

Appendix II

BRIEFING STATEMENT

PREPARED FOR: Refuges, Pacific Southwest Region, U.S. Fish and Wildlife Service

DATE: January 13, 2015

TITLE: Emergency Predator Management at Bitter Creek National Wildlife Refuge in Kern County, California in Response to Recent California Condor Mortality Events

ISSUE: Protection of California condors from a specific threat of predation

BACKGROUND: California condors (*Gymnogyps californianus*) regularly occur on the Bitter Creek NWR (Refuge) in Kern County, California. The Refuge is the primary release site for captive bred condors into the Southern California flock, and is also the primary location for trapping condors for lead testing, transmitter replacement, and general health checks. The Refuge and the adjacent properties include roosting, foraging, and nesting habitat.

During the first half of October 2014, four deceased condors were located by U.S. Fish and Wildlife Service (USFWS) staff near a roost site on the Refuge, in an area known as the Headwall of Bitter Creek Canyon. One of the four condors was a 20-year-old adult male (#63), had been in the wild for three years, and had raised a chick to fledging with his mate at their nest site on the Headwall in 2013. Two of the deceased condors were juvenile captive releases (#639 and #695) that had been released into the wild for the first time from the nearby Bitter Creek flight pen approximately one week prior to their death. The fourth condor was a juvenile captive release (#637) from the Fall of 2013. Initial surveys of the scene and the recovered remains of the condors indicated that all of the deceased condors likely succumbed as a result of predation.

USFWS requested the assistance of the California USDA Wildlife Services program (WS) to determine what predator was responsible for the condor mortalities and any possible solutions to prevent any further predation events of California condors in the area. After a site visit on October 29, 2014 and review of the mortality reports for the four condors, WS confirmed that the three juveniles were a classic case of bobcat (*Lynx rufus*) predation and caching. The cause of death for the adult condor was difficult to determine given the condition of the remains due to length of time exposed to the elements and post mortem scavenging. However, WS felt that the same bobcat responsible for the other three mortalities was also a likely culprit if the adult's demise due to the close proximity and timing to the other predations. To prevent the predation of any additional condors on the Refuge, WS recommended trapping and lethal removal of up to five bobcats near the area where the condor carcasses were found.

ACTIONS TAKEN:

- Condor recovery actions (e.g. releasing captive bred birds into the wild and bi-annual trapping of free-flying condors for lead testing, health checks, and transmitter upkeep) on the Refuge were halted after the discovery of the fourth predated condor on October 16, 2014. The decision was made to not resume these actions until the predation threat is alleviated. The remaining new captive release was trapped and brought back into captivity and all captive releases were transferred to other partner's release sites and/or zoos.
- USFWS received a letter from the California Department of Fish and Wildlife (CDFW) serving as a cooperative agreement with USFWS and/or WS for predator management authorizing the

take of up to five bobcats on the Refuge and adjacent Bureau of Land Management (BLM) lands from November 13, 2014 - December 4, 2014.

- Padded leg-hold traps were set by WS District Supervisor, Eric Covington, near the area where the condor carcasses were located. Bobcat specific scent lures were used to attract bobcats to the traps instead of meat baits to prevent the possibility of a condor being trapped. The traps were checked daily by WS or USFWS staff. See Figure 1 for Predator Management Trapping Effort.
- A fifth deceased condor (#658) is found within 50 meters of one of the leg-hold trap sites on the Headwall on the evening afternoon of November 21, 2014. The fresh remains and their position indicate predation as the cause of death with a bobcat being the most likely culprit.
- Three game cameras were set up by USFWS in the area where the fifth condor was located on November 25, 2014.
- A large approximately 5-year-old female bobcat was trapped and lethally dispatched by WS Eric Covington on November 26, 2014. The three traps were unset that same day and not reset again until November 30, 2014 due to lack of personnel to check them.
- A bobcat was picked up on one of the three game cameras on the night of November 28, 2014. As a result, USFWS requested an extension for trapping from CDFW and was authorized to extend the trapping time-frame to November 13, 2014 through January 1, 2015.
- One gray fox (*Urocyon cinereoargenteus*) was trapped and freed by WS on December 11, 2014.
- Two gray foxes were trapped and freed by WS on December 14, 2014.
- One gray fox was trapped and freed by WS on December 15, 2014.
- One gray fox was trapped and euthanized by WS on December 24, 2014 due to a broken leg.
- All remaining traps were unset on January 1, 2015 by USFWS and removed by WS on January 3, 2015.

CURRENT STATUS/ KEY POINTS:

- Although bobcats were observed on the Refuge and BLM lands after the euthanization of the bobcat in the Headwall on November 26, 2015, no fresh sign was observed in the near vicinity of the five predated condors. WS believes the bobcat caught on the game camera two nights after the bobcat was euthanized was likely just a transient bobcat moving through now that the large female was no longer in her territory. No more condors have been predated in the immediate area since #658 on November 21, 2014. Given this information, USFWS and WS feel that the threat predation is alleviated for now and that the euthanized bobcat was likely the one responsible for all five predations.
- USFWS LE Forensics Laboratory in Ashland, Oregon has recently released final necropsies for #695, #637, and #63 with trauma associated with predation being the cause of death. Only preliminary reports for #639 and #658 have been released but their initial findings are similar to the other three predated condors.
- No captive released condors from 2014 remain in the free-flying southern California population.
- The bi-annual trapping of the free flying condors at the Refuge was started up again on January 5, 2014 and will continue through the end of the month.

This briefing statement is provided as a courtesy. No action requested.

PREPARED BY: Michael Brady, Project Leader, Hopper Mountain National Wildlife Refuge Complex (805) 644-5185

Appendix III

USFWS Hopper Mountain National Wildlife Refuge Complex

California Condor Recovery Program

Facilities and Husbandry Review

December 2014

Purpose

This review was conducted to perform a comprehensive assessment of the condor husbandry practices and condor holding facilities at the Hopper Mountain National Wildlife Refuge Complex (Complex). To perform this review we sought input from experts in captive condor/avian practices and standards. As a result we generated a list of recommendations based on this input in order to standardize practices and improve condor safety while captive at the Complex field sites, Bitter Creek National Wildlife Refuge (Bitter Creek NWR) and Hopper Mountain National Wildlife Refuge (Hopper Mountain NWR).

Methods

Complex staff invited experts in wild animal/condor husbandry from Los Angeles Zoo and Santa Barbara Zoo to visit each condor flight pen location for an inspection and discussed with the potential threats that condors could face while captive at each field site. Condor husbandry and isolation practices were also discussed and compared to the practices of each of the zoos' condor facilities.

Site Visit dates and Attendants

19 Aug 2014, Noon-4:00pm: Hopper Mountain Facility
Attendants: Joseph Brandt (USFWS), Dan Tappe (USFWS), Estelle Sandhaus (SBZ), Sheri Horiszny (SBZ), Rachel Miller Ritchason (SBZ), Mike Clark (LAZ)

20 Aug 2014 11:00am-3:00pm: Bitter Creek Facility
Attendants: Joseph Brandt (USFWS), Matt Hillman (USFWS), Estelle Sandhaus (SBZ), Sheri Horiszny (SBZ), Mike Clark (LAZ)

External/Environmental Threats

Four primary threats were identified as potential dangers for condors while captive in refuge flight pens: predation, wildfire, severe weather, and vandalism. Measures to eliminate or minimize each of these threats were each discussed among the group and recommendations were developed as a result of those discussions. These recommendations were categorized by threat and then by refuge. Rationale and priority of the action is specified for each recommendation. Table 1 (page 11) lists all the recommendations for the Bitter Creek NWR and Table 2 (page12) lists all the recommendations for the Hopper Mountain NWR.

Predators

Given the remote location of each flight pen and because carrion is placed in the pen regularly to feed condors, predators can be attracted to flight pens and can be a risk to condors while held captive at the refuge condor facilities. Predators could consist of coyotes, bobcats, bears, and mountain lions. All present a serious danger to condors especially while they are in an enclosed space such as a flight pen. Discussion about the threat of predators was primarily focused on eliminating the threat by creating an adequate barrier between predators and captive condors. In other words, the flight pen must be secure enough to not allow predators into the flight pen. Other measures discussed were secondary to keeping the pen secure and were related to increasing the perch space in the flight pen and reducing the attractants by limiting the period of time when carrion is available.

Bitter Creek NWR Recommendations:

1. ***BC_PRED1***: Install 8 to 10 additional perch spaces for condors to use in the flight pen.

    - *Rationale*: In the event that a predator gains access to the flight pen additional perches, especially shelves, might allow captive condors to evade the predator. Currently, there are approximately 30 perch locations (Picture 1). Eight to 10 additional perch locations should be added. In general perches should be easy to use for condors. Shelves and large lateral branches are best but a variety of perched will also help the condors adapt to new types of perches once released into the wild.

    - *Priority*: Additional perches are not necessary for the flight pen to be usable but this easy to implement, low cost action may provide some protection if the cage is breached. January 2015 is the suggested completion date.

Picture 1: Eighteen condors awaiting release in the Bitter Creek NWR flight pen. The flight pen currently has enough space for 30 condors (perch space for ~25 condors shown). Installing additional shelving along one side of the pen is recommended to add additional perch space.

2. ***BC_PRED2***: Replace the underground fencing in the double door trap with a concrete curb that is 24" deep.

    - *Rationale*: The double door trap at Bitter Creek NWR has underground fencing that acts as a digging barrier but installing concrete is recommended because fencing material buried underground has the potential to erode over time.

    - *Priority*: The underground fencing should last for at least two years but should be replaced at some point within that time span. December 2016 is the suggested completion date.

3. ***BC_PRED3:*** Replace the perimeter fence with an 8' chain-link fence topped with angled out barbwire with a concrete curb buried 24" deep.

    - *Rationale*: The perimeter fencing at both refuges is inadequate. The standard perimeter fence used at zoos is an 8' chain-link fence. This fence should also be installed with a concrete curb buried 24" into the ground. Prior to installing a perimeter fence, 8' markers should be placed to test for take-off and landing clearance.

    - Priority: The installation of a chain link fence will not prevent the flight pen from being usable but it will increase the security around the pen for both predators and trespassers. January 2016 is the suggested completion date

<u>Hopper Mountain NWR Recommendations</u>:

1. ***HM_PRED1:*** Install a concrete curb around the base of the flight pen that is 24" deep and raised 3' to 6' above the ground. The cage fencing of the flight pen should be connected to the curb.

- *Rationale:* Concrete curbs are necessary in order to prevent predators from digging under the flight cage to gain access and a raised curb prevents the erosion of fencing material.

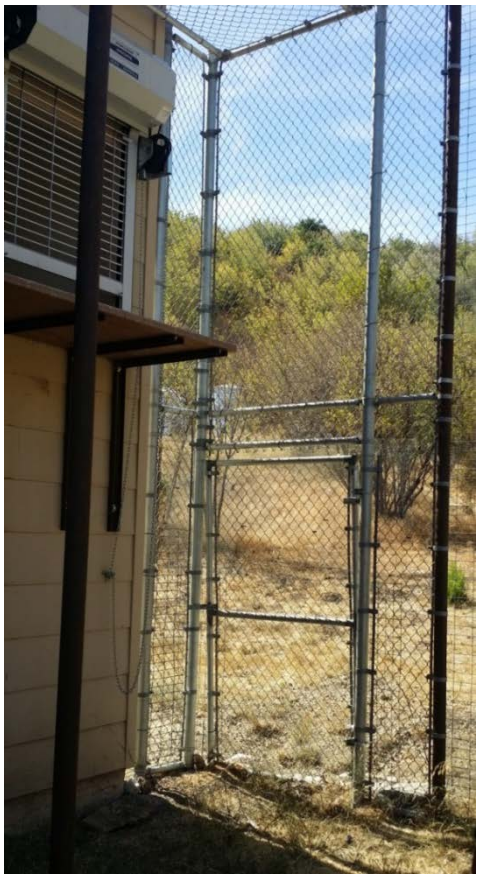
- *Priority:* A concrete curb must be installed in order for the flight pen to be usable. Predators have already attempted to dig their way into flight pen at Hopper (Picture 2). June 2015 is the suggested completion date

Photo 2: An attempt by a predator to dig into the flight pen.

2. ***HM_PRED2*:** Eliminate all gaps larger than two inches in the Hopper Mountain NWR flight pen cage.

    - *Rationale:* The Hopper Mountain NWR flight pen has a number of gaps in the fencing that were the result of the new construction being tied into the old pen (Picture 3 & 4). There is also space the between the building and the new portion on the flight pen (Picture 5). Some of these gaps are large enough to allow small predators, such as bobcats, access to the interior of the pen.

    - *Priority:* All gaps must be eliminated in order for the flight pen to be usable. On July 18, 2014, a bobcat entered the flight pen through a gap (Picture 5) and killed one of the condors captive in the pen. The pen is considered unusable until the all gaps in fencing are sealed and a barrier to digging under fence has been replaced. June 2015 is the suggested completion date.



Pictures 3 & 4: Chain-link fence was used to tie the new building into the existing flight pen creating gaps that predators are capable of getting through.

Picture 5. Entrance hole of a bobcat that killed a captive condor on July 18, 2014 at Hopper Mountain NWR flight pen. The gap is approximately 3.5 inches wide.

3. ***HM_PRED3:*** Replace the perimeter fence with an 8' chain-link fence topped with angled out barbwire with a concrete curb buried 24" deep

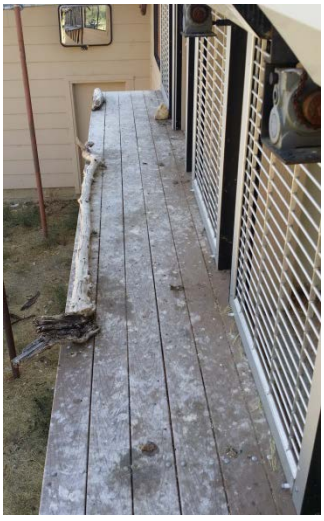
    - *Rationale*: The perimeter fencing at both refuges is inadequate. The standard perimeter fence used at zoos is an 8' chain-link fence. In some cases angled out barb wire lines the top of the fence but this may pose an additional hazard for condor as they take flight from the flight pen area. This fence should also be installed or the fence should be buried 24" into the ground. Prior to installing a perimeter fence 8 'markers should be placed to test for take-offs and landing clearance.

    - Priority: The installation of a chain link fence will not prevent the flight pen from being usable but it will increase the security around the pen for both predators and trespassers. January 2016 is the suggested completion date.

4. ***HM_PRED4***: Install 8 to 10 additional perch spaces for condors to use in the flight pen.

    - *Rationale*: In the event that a predator gains access to the flight pen additional perches, especially shelves, might allow captive condors to evade the predator. Currently, there are approximately 25 perching locations (Picture 6 & 7). Eight to 10 additional perch locations should be added. In general perches should be easy to use for condors. Shelves and large lateral branches are best but a variety of perched will also help the condors adapt to new types of perches once released into the wild.

    - *Priority*: Additional perches are not necessary for the flight pen to be usable but this easy to implement, low cost action may provide some protection if the fence is breached. January 2015 is the suggested completion date.



Pictures 6 & 7: Existing perches at the Hopper Mountain NWR flight pen. The pen currently has enough perch space for 25 condors; an additional 8 to 10 perches are recommended.

Wildfire

Bitter Creek NWR and Hopper Mountain NWR are both susceptible to wildfires and are located in an area with a variety of fuel types including grassland and chaparral vegetation where fires can burn very quickly. Without appropriate protection and response plans a fire could result in the loss of all captive condors. In order to reduce the potential for this kind of catastrophic event the group discussed the need for appropriate fire clearing around each flight pen and evacuation plans.

Bitter Creek NWR Recommendations:

1. **BC_FIRE1:** Create a fire clearing of 200' or 5' beyond the perimeter fence (whichever is the greater distance.

    - *Rationale*: An adequate fire clearing should be maintained during fire season. California law requires a minimum of 100' of defensible space around structures.

    - *Priority:* Condors should not be held in flight pens without a fire clearing during the fire season. Fire clearing should occur annually during the month of May and maintained throughout the fire season.

2. **BC_FIRE2***:* Install a large (10'x15'minimim) quick release escape hatch on the flight pen.

    - *Rationale*: An escape hatch should allow for the quick release of captive birds in the event of an emergency. The opening should be large and obvious enough such that it would allow for a near immediate escape. The hatch should operable by a single person with little to no training.

    - *Priority: The* flight pen may be used without an escape hatch installed an escape hatch should be designed and installed prior to June of 2015.

3. **BC_FIRE3:** Develop and evacuation plan for captive condors in the event of a wildfire or other emergency.

    - *Rationale*: These plans should take into account the time available for the evacuation and age of the birds being evacuated recognizing that a well-protected flight pen might be the safest location for inexperienced pre-release condors.

    - *Priority***:** A plan should be written and distributed by June of 2015. The flight pen may be used without a formal evacuation plan.

4. **BC_FIRE4:** Refuges should avoid periods without staff when condors are captive in the flight pen.

    - *Rationale*: Given the need to respond to captive condor related emergencies and the daily requirement to check on the status of captive condors each day staff is required to be present on refuge whenever condors are captive on the refuge.

    - *Priority:* This practice should be implemented immediately.

5. **BC_FIRE5:** Refuges should always have enough kennels present on site to evacuate captive condors.

- *Rationale*: In order to allow for the safe evacuation of captive condors the refuge should always have enough kennels to evacuate all captive condors being held at the refuge.

- Priority: This practice should be implemented immediately.

6. **BC_FIRE6:** Flight pen locations should be communicated to the local fire protection agencies responsible for each refuge and entered into the Wildfire Decision Support System along with other condor sensitive areas to avoid any harm caused by fire suppression activities.

    - *Rationale*: Fire suppression activities that take place near the refuge flight pen must take into consideration any effect on captive condors.

    - *Priority:* The flight pen locations and restricted types of fire suppression activities should be discussed with local fire agencies immediately and information regarding the flight pen should be entered into Wildfire Decision Support System by June of 2015.

Hopper Mountain NWR Recommendations:

1. **HM_FIRE1:** Create a fire clearing of 200' or 5' beyond the perimeter fence (whichever is the greater distance).

    - *Rationale:* An adequate fire clearing should be maintained during fire season. California law requires a minimum of 100' of defensible space around structures. The fire clearing should be maintained throughout the fires season.

    - *Priority:* Condors should not be held in flight pens without a fire clearing during the fire season. Fire clearing should occur during the month of May every year and maintained throughout the fire season.

2. **HM_FIRE2***:* Install a large (10'x15'minimim) quick release escape hatch on the flight pen.

    - *Rationale*: An escape hatch should allow for the quick release of captive birds in the event of an emergency. The opening should be large and obvious enough such that it would allow for a near immediate escape. The hatch should operable by a single person with little to no training.

    - *Priority: The* flight pen may be used without an escape hatch installed an escape hatch should be designed and installed prior to June of 2015.

3. **HM_FIRE3:** Develop and evacuation plan for captive condors in the event of a wildfire or other emergency.

    - *Rationale*: These plans should take into account the time available for the evacuation and age of the birds being evacuated recognizing that a well-protected flight pen might be the safest location for inexperienced pre-release condors.

    - *Priority***:** A plan should be written and distributed by June of 2015, the flight pen may be used without a formal evacuation plan

4. **HM_FIRE4:** Refuges should avoid periods without staff when condors are captive in the flight pen.

    - *Rationale*: Given the need to respond to captive condor related emergencies and the daily requirement to check on the status of captive condors each day staff is required to be present on refuge whenever condors are captive on the refuge.

    - *Priority:* This practice should be implemented immediately.

5. **HM_FIRE5:** Refuges should always have enough kennels present on site to evacuate captive condors.
    - *Rationale*: In order to allow for the safe evacuation of captive condors the refuge should always have enough kennels to evacuate all captive condors being held at the refuge.

    - Priority: This practice should be implemented immediately.

6. **HM_FIRE6:** Flight pen locations should be communicated to the local fire protection agencies responsible for each refuge and entered into the Wildfire Decision Support System along with other condor sensitive areas to avoid any harm caused by fire suppression activities.

    - *Rationale*: Fire suppression activities that take place near the refuge flight pen must take into consideration any effect on captive condors.

    - *Priority:* The flight pen locations and restricted types of fire suppression activities should be discussed with local fire agencies immediately and information regarding the flight pen should be entered into Wildfire Decision Support System by June of 2015.

Severe weather

Like wildfire, severe weather such as high winds, lightning or flooding could pose a threat to condors while in captivity. Winds have damaged the integrity of the flight pen in the past when too much shade barriers were attached to the roof at the Bitter Creek Flight Pen.

Bitter Creek NWR Recommendations:

1. **BC_WTHR1:** Develop evacuation procedure in the event of any extreme weather events.

    - *Rationale*: These plans should take into account the time available for the evacuation and age of the birds being evacuated recognizing that a well-protected flight pen might be the safest location for inexperienced pre-release condors.

    - *Priority***:** A plan should be written and distributed by June of 2015. The flight pen may be used without a formal evacuation plan

Hopper Mountain NWR Recommendations:

1. **HM_WTHR1:** Develop evacuation procedure in the event of any extreme weather events.

- *Rationale*: These plans should take into account the time available for the evacuation and age of the birds being evacuated recognizing that a well-protected flight pen might be the safest location for inexperienced pre-release condors.

- *Priority***:** A plan should be written and distributed by June of 2015. The flight pen may be used without a formal evacuation plan.

Vandalism

There is a potential for trespassers to gain access to refuge flight pens in order to cause damage to the structure, harm captive condors, or allow them to escape. Both refuges have had instances of trespassers in the past and in one occasion a person did approach the flight pen but only to look at the condors. The current flight pen locations are well sited as they are not visible from any public roads and the refuges are relatively remote.

Bitter Creek NWR Recommendations:

1. **BC_VAND1:** Improve the perimeter fencing (8 ft. chain link) with lockable gates and topped with angled out barbed wire. Lock gates when flight pen area is not occupied by staff.

    - *Rationale*: The perimeter fencing at both refuges is inadequate. The standard perimeter fence used at zoos is an 8' chain-link fence. Prior to installing a perimeter fence 8' markers should be placed to test for take-off and landing clearance.

    - Priority: The installation of a chain link fence will not prevent the flight pen from being usable but it will increase the security around the pen for both predators and trespassers.

2. **BC_VAND2:** The turns off that leads directly to the flight pen and perimeter fence to each flight pen should be signed for restricted access.

    - Rationale: Signs that clearly state restricted area may deter individuals who should not enter restricted areas.

    - *Priority***:** The flight pen may be used without signs but signs should be manufactured and installed by the January of 2015.

3. **BC_VAND3:** Surveillance cameras should be used to for the dual purpose of monitoring captive condors in the flight pen and providing additional security against vandals.

    - Rationale: Security cameras would discourage vandalism by recording the activity of individuals in restricted areas and providing evidence of any acts of vandalism. They would also allow remote monitoring of any condors captive inside the flight pen.

    - *Priority***:** The flight pen may be used without security cameras but cameras should be installed by the January of 2016.

4. **BC_VAND4:** Refuges should avoid periods without staff when condors are captive in the flight pen.
    - *Rationale*: Given the need to respond to captive condor related emergencies and the daily requirement to check on the status of captive condors each day staff is required to be present on refuge whenever condors are captive on the refuge.

- *Priority:* This practice should be implemented immediately.

Hopper Mountain NWR Recommendations:

4. **HM_VAND1:** Improve the perimeter fencing (8 ft chain link) with lockable gates and topped with angled out barbed wire. Lock gates when flight pen area is not occupied by staff.

    - *Rationale*: The perimeter fencing at both refuges is inadequate. The standard perimeter fence used at zoos is an 8' chain-link fence. Prior to installing a perimeter fence 8' markers should be placed to test for take-offs and landing clearance.

    - Priority: The installation of a chain link fence will not prevent the flight pen from being usable but it will increase the security around the pen for both predators and trespassers.

2. **HM_VAND2:** At the road intersections that directly to the flight pen and the perimeter fence to each flight pen should be signed for restricted access.

    - Rationale: Signs that clearly identify restricted areas may deter individuals who should not enter restricted areas.

    - *Priority***:** The flight pen may be used without signs but signs should be manufactured and installed by the January of 2015.

3. **HM_VAND3:** Surveillance cameras should be used to for the dual purpose of monitoring captive condors in the flight pen and providing additional security against vandals.

    - Rationale: Security cameras would discourage vandalism by recording the activity of individuals in restricted areas and providing evidence of any acts of vandalism. They would also allow remote monitoring of any condors captive inside the flight pen.

    - *Priority***:** The flight pen may be used without security cameras but cameras should be installed by the January of 2016.

4. **HM_VAND4:** Refuges should avoid periods without staff when condors are captive in the flight pen.

    - *Rationale*: Given the need to respond to captive condor related emergencies and the daily requirement to check on the status of captive condors each day staff is required to be present on refuge whenever condors are captive on the refuge.

    - *Priority:* This practice should be implemented immediately.

Table1: Bitter Creek NWR flight pen recommendations for external/environmental threats.

Recommendation Numbers	Threat Categories	Recommendation Description	Target
BC_PRED1	*Predation*	Install 8 to 10 additional perch spaces for condors to use in the flight pen.	*January 2015*
BC_PRED2	*Predation*	Replace the underground fencing in the double door trap with a 24" deep concrete curb.	*December 2016*
BC_PRED3, BCVAND1	*Predation, Vandalism*	Replace the perimeter fence with an 8' chain-link fence topped with angled out barbwire with a concrete curb buried 24" deep.	*January 2016*
BC_FIRE1	*Wildfire*	Annually Create a fire clearing of 200' or 5' beyond the perimeter fence (whichever is the greater distance.	*May 2015*
BC_FIRE2	*Wildfire*	Install a large (10'x15'minimim) quick release escape hatch on the flight pen.	*June 2015*
BC_FIRE3, BC_WTHR1	*Wildfire, Severe Weather*	Develop and evacuation plan for captive condors in the event of a wildfire, severe weather event or other emergency.	*June 2013*
BC_FIRE4, BC_VAND4	*Wildfire, Vandalism*	Refuges should avoid periods without staff when condors are captive in the flight pen.	*Immediately*
BC_FIRE5	*Wildfire*	Refuges should always have enough kennels present on site to evacuate captive condors.	*Immediately*
BC_FIRE6	*Wildfire*	Flight pen locations should be communicated to the local fire protection agencies responsible for each refuge and entered into the Wildfire Decision Support System along with other condor sensitive areas to avoid any harm caused by fire suppression activities.	*June 2015*
BC_VAND2	*Vandalism*	At the road intersection that leads directly to the flight pen and perimeter fence to each flight pen should be signed for restricted access.	*January 2015*
BC_VAND3	*Vandalism*	Surveillance cameras should be used to for the dual purpose of monitoring captive condors in the flight pen and providing additional security against vandals.	*January 2016*

Table2: Hopper Mountain NWR flight pen recommendations for external/environmental threats.

Recommendation Numbers	Threat Categories	Recommendation Description	Target
HM_PRED1	*Predation*	Install a concrete curb around the base of the flight pen that is 24" deep and raised 3' to 6' above the ground. The fencing of the flight pen should be connected to the curb.	*June 2015*
HM_PRED2	*Predation*	Eliminate all gaps larger than two inches in the Hopper Mountain NWR flight pen.	*June 2015*
HM_PRED3, HMVAND1	*Predation, Vandalism*	Replace the perimeter fence with an 8' chain-link fence topped with angled out barbwire with a concrete curb buried 24" deep.	*January 2016*
HM_PRED4	*Predation*	Install 8 to 10 additional perch spaces for condors to use in the flight pen.	*January 2015*
HM_FIRE1	*Wildfire*	Annually Create a fire clearing of 200' or 5' beyond the perimeter fence (whichever is the greater distance.	*May 2015*
HM_FIRE2	*Wildfire*	Install a large (10'x15'minimim) quick release escape hatch on the flight pen.	*June 2015*
HM_FIRE3, HM_WTHR1	*Wildfire, Severe Weather*	Develop and evacuation plan for captive condors in the event of a wildfire, severe weather event or other emergency.	*June 2013*
HM_FIRE4, HM_VAND4	*Wildfire, Vandalism*	Refuges should avoid periods without staff when condors are captive in the flight pen.	*Immediately*
HM_FIRE5	*Wildfire*	Refuges should always have enough kennels present on site to evacuate captive condors.	*Immediately*
HM_FIRE6	*Wildfire*	Flight pen locations should be communicated to the local fire protection agencies responsible for each refuge and entered into the Wildfire Decision Support System along with other condor sensitive areas to avoid any harm caused by fire suppression activities.	*June 2015*
HM_VAND2	*Vandalism*	At the road intersection that leads directly to the flight pen and perimeter fence to each flight pen should be signed for restricted access.	*January 2015*
HM_VAND3	*Vandalism*	Surveillance cameras should be used to for the dual purpose of monitoring captive condors in the flight pen and providing additional security against vandals.	*January 2016*

Husbandry Practices

The care of captive condors at Hopper Mountain NWR and Bitter Creek NWR condor facilities occurs throughout the year during periods of trapping and while holding captive bred condors prior to their release into the wild. It is the responsibility of complex staff to ensure that the condors receive adequate care and are held in appropriate facilities while captive. The topics discussed during the review related to four husbandry practices: food/water provisions, flight pen hazards, monitoring, and condor/human interaction.

Food/Water Provision

Condors require an adequate amount of food and clean water while captive. This can most simply be quantified by the amount of food needed on a daily basis. However, there are a number of factors that will change the feeding behavior of condors while captive so it is important to have a flexible feeding schedule that monitors the amount of food already available to the captive birds. Fresh water should be available at all times while birds are captive and needs to be flowing or changed frequently, especially when temperatures are high.

Bitter Creek NWR Recommendations:

1. **BC_FDWT1**: Change the way flight pen feedings are recorded so that it is separate from the supplemental feeding sites. Record when and how much food (type and # of carcasses) is provisioned to condors and when the water source is cleaned.
    - *Rationale*: Flight pen feeding data is currently grouped with supplemental food placements for the wild population. This can lead to confusion about when food was placed in the flight pen for captive condors vs. when the flight pen trap site is baited for wild condors.
    - *Priority*: This practice should be implemented immediately
2. **BC_FDWT2:** A more automated water delivery system that is and flowing should be used to provide clean water to captive condors.
    - *Rationale*: The current water system at the flight pen requires standing water to be replaced from a pond manually every two to three days. Flowing water would be a cleaner water source and would not need to changed manual making it a more dependable source of clean water for captive condors.
    - *Priority*: The flight pen may be used without an improved water delivery system a system should be installed by the June of 2016.

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- *Priority*: This practice should be implemented immediately

2. **HM_FDWT2:** A more automated water delivery system that is and flowing should be used to provide clean water to captive condors.

    - *Rationale*: The current water system at the flight pen requires standing water to be replaced from a pond manually every two to three days. Flowing water would be a cleaner water source and would not need to changed manual making it a more dependable source of clean water for captive condors.

    - *Priority*: The flight pen may be used without an improved water delivery system a system should be installed by the June of 2016.

Flight Pen Hazards

The team noticed a number of hazards in the flight pen structure that should be eliminated prior to holding condors in each pen. These consisted of sharp edges or potential spots where a condor could become entangled. Other features were pointed out that could potentially be ingestion hazards such as old plywood, flaking paint, and loose hardware.

Bitter Creek NWR **Recommendations:**

1. **BC_HZRD1:** The drain grates for both flight pen water ponds should be replaced with stronger material.

    - *Rationale:* The drain cover currently installed could be broken off by condors tugging at it and ingested.

    - *Priority:* The current drain covers should be removed immediately and new drain covers should be installed by January of 2015.

2. **BC_HZRD2:** The flight pen should be inspected for all sharp edges and remove them (i.e. hog mesh that is not properly trimmed, nails metal shards on flight pen support poles, etc.)

    - *Rationale:* Sharp edges pose a hazard to condors, especially as they are being chased around the pen to be netted.

    - *Priority:* Inspection and removal of sharp edges must occur before the flight pen is considered usable.

3. **BC_HZRD3:** All wiring used to attach the perches should be replaced with a better attachment method.

    - *Rationale:* Wire used in the construction of perches will corrode and breakdown and create materials that can be ingested by captive condors. Wire may also become loose allowing condors to get their toes stuck in the wiring.

    - *Priority:* All wiring should immediately be inspected to make sure that it is not corroded or loose. All wire should be replaced by January 2015.

4. **BC_HZRD4:** The nails preventing captive condors from perching on the power pole center post at Bitter Creek NWR should be removed and replaced with Nixalite.
    - *Rationale:* The nails on the power pole center post are a hazard to condors, especially as they are being chased around the pen to be netted.

    - *Priority:* These nails should be removed before the flight pen is considered usable.

5. **BC_HZRD5**: Flight pens should be inspected on an annual or biannual basis to be sure there are no additional hazards that have developed. Group discussed performing a review such as this on a regular schedule as well.

    - *Rationale:* All structures require regular maintenance and up keep. Without regular inspections and upkeep new hazards could develop in the flight pen.

    - *Priority:* Inspections should occur once a year in the spring and following any major modifications made to the flight pen.

Hopper Mountain NWR **Recommendations:**

1. **HM_HZRD1**: The iso-pen door gearing and chains at the Hopper Mountain flight pen should be covered or removed (Picture 8 & 9).

    - *Rationale:* The iso-pen door gearing is a hazard to condors, especially as they are being chased around the pen to be netted.

    - *Priority:* The flight pen should not be used until iso-pen door gearing is removed or covered.

Picture 8 & 9: The gearing of the iso-pen doors in the Hopper Mountain NWR flight pen should be removed or covered because of the hazard it presents to captive condors.

2. **HM_HZRD2:** The drain grate for the flight pen water pond should be replaced with stronger material.

    - *Rationale:* The drain cover currently installed could be broken off by condors tugging at it and ingested.

    - *Priority:* The current drain covers should be removed immediately and new drain covers should be installed by January of 2015.

3. **HM_HZRD3:** Each pen should be inspected for all sharp edges and correct and remove them (i.e. hog mesh that is not properly trimmed, nails metal shards on flight pen support poles, etc.)

    - *Rationale:* Sharp edges pose a hazard to condors, especially as they are being chased around the pen to be netted.

    - *Priority:* Inspection and removal of sharp edges must occur before the flight pen is considered usable.

4. **HM_HZRD4:** All wiring used to attach the perches should be replaced with a better attachment method.

    - *Rationale:* Wire used in the construction of perches will corrode and breakdown and create materials that can be ingested by captive condors. Wire may also become loose allowing condors to get their toes stuck in the wiring.

    - *Priority:* All wiring should immediately be inspected to make sure that it is not corroded or loose. All wire should be replaced by January 2015.

5. **HM_HZRD5:** The flight pen should be inspected on an annual or biannual basis to be sure there are no additional hazards that have developed. Group discussed performing a review such as this on a regular schedule as well.

    - *Rationale:* All structures require regular maintenance and up keep. Without regular inspections and upkeep new hazards could develop in the flight pen.

    - *Priority:* Inspections should occur once a year in the spring and following any major modifications made to the flight pen.

Monitoring

Captive condors should be observed periodically while held in a flight pen. It is important that each condor in the pen is accounted for and assessed to ensure they are healthy. Pre-release condors must also be observed to determine whether they are ready to be released. The team discussed how often condors are checked at each zoo and ways to check on condors while captive in each pen.

Bitter Creek NWR Recommendations:

1. **BC_MONT1**: Refuges should avoid or minimize periods without staff when condors are captive in the flight pen.

- *Rationale:* Given the need to respond to captive condor related emergencies and the daily requirement to check on the status of captive condors each day staff is required to be present on refuge whenever condors are captive on the refuge.

- *Priority:* This practice should be implemented immediately.

2. **BC_MONT2:** Morning and evening checks of captive condors should occur daily and four hour pre-release observations should occur at least twice a week. Newly trapped condors should be observed for at least one hour after being trapped to ensure there are no signs of illness or injury.

    - *Rationale:* Daily checks and biweekly detailed observations of captive condors are necessary to quickly identify any health or safety concerns for condors while they are held captive.

    - *Priority:* This practice should be implemented immediately.

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    - *Rationale:* Daily checks and biweekly detailed observations of captive condors are necessary to quickly identify any health or safety concerns for condors while they are held captive.

    - *Priority:* This practice should be implemented immediately

Condor/Human Interaction

In general captive condors should be kept isolated from human activity around the flight pen. When handling condors it is necessary for people to enter the flight pen to net and retrieve the condor. This involves flushing condors from their perches onto the ground or into an enclosed space so it can be easily netted. Many of the captive breeding facilities use smaller catch pens in a flight pen and lure condors into this area to trap them however this technique is not practical in a field setting given the need to trap and handle a large number of condors in a single handling event. The review team discussed using hog mesh vs. flexible wire mesh and the pros and cons associated with each material. Hog mesh is less prone to foot injury in the event that condors cling-flap and mesh climb where as flexible wire mesh will have more give in if a condor collides into the mesh.

Bitter Creek NWR Recommendations:

1. **BC_HINT1:** The Bitter Creek NWR flight pen should have more iso-pens to reduce the number of times a person needs to enter the flight pen to wrangle a group of captive condors.

    - *Rationale:* Iso-pens allow biologists to contain multiple condors each time they enter the flight pen to net them. This reduces amount of time condors are being chased around the flight pen thus reducing the stress all captive condors.

    - *Priority:* Adding iso-pens to the Bitter Creek flight pen will require a significant planning and resources. A reasonable target for the completion of this recommendation is June of 2016.

2. **BC_HINT1:** Removable perches should be used to allow condors to be netted more easily.

    - *Rationale:* By removing or lowering perches when trying to net a condor in the flight pen, they would be forced to perch closer to the ground or nest box and become easier to net.

    - *Priority:* Removable perches need to be designed and tested to ensure their functionality Completion of this task is dependent on this process.

Hopper Mountain NWR Recommendations:

1. **HM_HINT1:** Removable perches should be used to encourage condors into iso-pens.

    - *Rationale:* By removing or lowering perches when trying to net a condor in the flight pen, they would be forced to perch closer to the iso-pens and become easier to trap.

    - *Priority:* Removable perches need to be designed and tested to ensure their functionality Completion of this task is dependent on this process.

2. **HM_HINT2**: Mirror glass should be marked to prevent collisions.

    - *Rationale:* The one way mirrored glass prevents condors from seeing observers in the flight pen blind. It can also pose a hazard when condors are being netted because the captive condors could confuse the mirrored glass with an exit.

    - *Priority:* Mirrored glass should be marked prior to the next time condors are netted in the flight pen.

3. **HM_HINT3:** The iso-pen doors at Hopper Mountain NWR should have their doors redesigned to improve ease of use and reduce noise.

    - *Rationale:* The operation of the iso-pen doors is slow and noisy. Improving the operation of these doors will allow condors to be contained more easily and with less stress to the condors.

    - *Priority:* Iso-pen door operation does not have to be improved for the flight pen to be functional. The improvements should be made by June of 2015.

Recommendation Numbers	Husbandry Practice	Recommendation Description	Target
BC_FDWT1	*Food and Water*	Change the way flight pen feedings are recorded so that it is separate from the supplemental feeding sites. Record when and how much food is provisioned to condors and when water source is cleaned.	*Immediately*
BC_FDWT2	*Food and Water*	A more automated water delivery system that is and flowing should be used to provide clean water to captive condors.	*June 2016*
BC_HZRD1	*Flight Pen Hazards*	The drain grates for both flight pen water ponds should be replaced with stronger material.	*June 2015*
BC_HZRD2	*Flight Pen Hazards*	The flight pen should be inspected for all sharp edges and remove them (i.e. hog mesh that is not properly trimmed, nails metal shards on flight pen support poles, etc.).	*Immediately*
BC_HZRD3	*Flight Pen Hazards*	All wiring used to attach the perches should be replaced with a better attachment method.	*June 2015*
BC_HZRD4	*Flight Pen Hazards*	The nails preventing captive condors from perching on the power pole center post at Bitter Creek should be removed and replaced with Nixalite.	*Immediately*
BC_HZRD5	*Flight Pen Hazard*	Flight pens should be inspected on an annual or biannual basis to be sure there are no additional hazards that have developed. Group discussed performing a review such as this on a regular schedule as well.	*May 2016*
BC_MONT1	*Monitoring*	Refuges should avoid periods without staff when condors are captive in the flight pen.	*Immediately*
BC_MONT2	*Monitoring*	Morning and Evening checks of captive condors should occur daily and 4 hour pre-release observations should occur at least twice a week. Newly trapped condors should be observed for at least one hour after being trapped to ensure there are no signs of illness or injury.	*Immediately*
BC_HINT1	*Human Interactions*	The Bitter Creek flight pen should have more iso-pens to reduce the number of times a person needs to enter the flight pen to wrangle a group of captive condors.	*June 2017*
BC_HINT2	*Human Interactions*	Removable perches should be used to allow condors to be netted more easily.	*TBA*

Table3: Bitter Creek NWR flight pen recommendations for Husbandry Practices

Recommendation Numbers	Husbandry Practice	Recommendation Description	Target
HM_FDWT1	*Food and Water*	Change the way flight pen feedings are recorded so that it is separate from the supplemental feeding sites. Record when and how much food is provisioned to condors and when water source is cleaned	*Immediately*
HM_FDWT2	*Food and Water*	A more automated water delivery system that is and flowing should be used to provide clean water to captive condors	*June 2016*
HM_HZRD1	*Flight Pen Hazards*	The iso-pen door gearing and chains at the Hopper Mountain NWR flight pen should be covered or removed.	*Immediately*
HM_HZRD2	*Flight Pen Hazards*	The drain grates for both flight pen water ponds should be replaced with stronger material	*June 2015*
HM_HZRD3	*Flight Pen Hazard*	The flight pen should be inspected for all sharp edges and remove them (i.e. hog mesh that is not properly trimmed, nails metal shards on flight pen support poles, etc.)	*Immediately*
HM_HZRD4	*Flight Pen Hazards*	All wiring used to attach the perches should be replaced with a better attachment method	*June 2015*
HM_HZRD5	*Flight Pen Hazard*	Flight pens should be inspected on an annual or biannual basis to be sure there are no additional hazards that have developed. Group discussed performing a review such as this on a regular schedule as well	*May 2016*
HM_MONT1	*Monitoring*	Refuges should avoid periods without staff when condors are captive in the flight pen.	*Immediately*
HM_MONT2	*Monitoring*	Morning and Evening checks of captive condors should occur daily and 4 hour pre-release observations should occur at least twice a week. Newly trapped condors should be observed for at least one hour after being trapped to ensure there are no signs of illness or injury.	*Immediately*
HM_HINT1	*Human Interactions*	Removable perches should be used to allow condors to be netted more easily.	*TBA*
HM_HINT2	*Human Interactions*	Mirror glass should be marked to prevent collisions	*Immediately*
HM_HINT3	*Human Interactions*	The iso-pen doors at Hopper Mountain NWR should have their doors redesigned to improve ease of use and reduce noise	*June 2015*

Table 4: Hopper Mountain NWR flight pen recommendations for Husbandry Practices.